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Petroleum Engineer

The Engineering Magazine of the Oil and Gas Industry

Volume 1 MAY, 1930 Number 8

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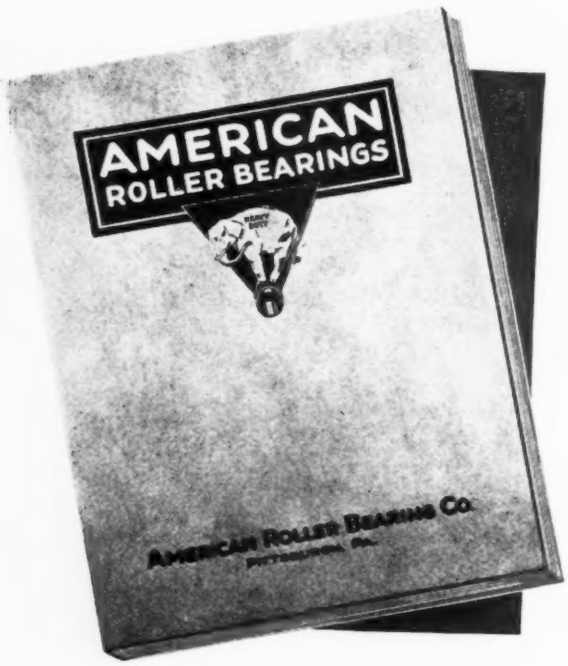

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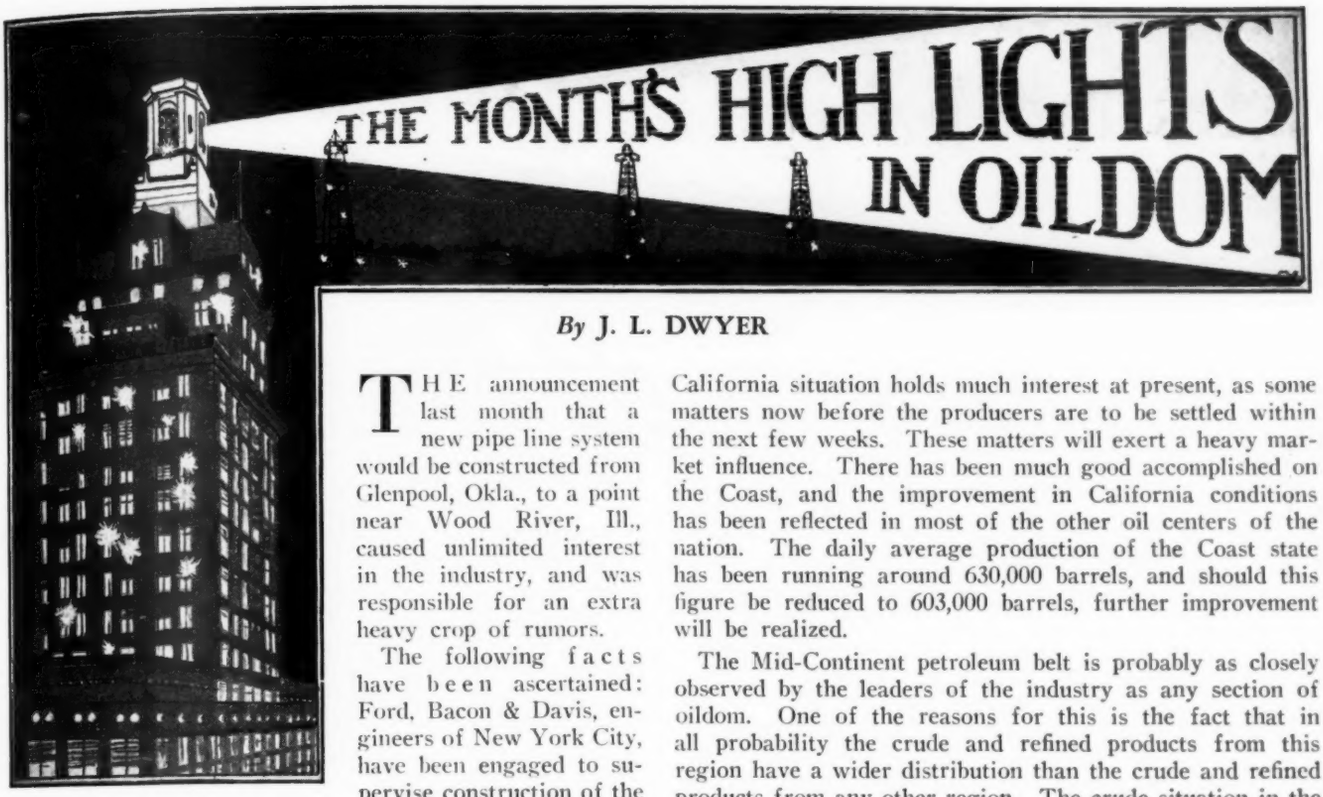


By J. L. DWYER

THE announcement last month that a new pipe line system would be constructed from Glenpool, Okla., to a point near Wood River, Ill., caused unlimited interest in the industry, and was responsible for an extra heavy crop of rumors.

The following facts have been ascertained: Ford, Bacon & Davis, engineers of New York City, have been engaged to supervise construction of the proposed line, and have established field offices at Springfield, Mo. Five surveying parties are now making the line's survey. A ten-inch line, covering a distance of approximately 360 miles, is planned. There will be nine main line pump stations of 60,000 barrels daily capacity. They will contain three units each. Orders for fifteen pumps were placed with one manufacturer, an order for six additional pumps, together with a tentative order for the remaining six, were placed with a second manufacturer. All orders were made f. o. b. the factory. It is rumored that an order for the pipe was placed, but this has not been confirmed.

Interest naturally centered in the identity of the company which would operate the line. It is believed that the line will be built and operated by the Standard Oil Company of New Jersey, and that its operation may be the forerunner of further expansions by that corporation.

The crude oil situation over the nation seems unsettled. Pennsylvania oils suffered price decreases last month, while a small territory in Ohio experienced an advance. The California situation holds much interest at present, as some matters now before the producers are to be settled within the next few weeks. These matters will exert a heavy market influence. There has been much good accomplished on the Coast, and the improvement in California conditions has been reflected in most of the other oil centers of the nation. The daily average production of the Coast state has been running around 630,000 barrels, and should this figure be reduced to 603,000 barrels, further improvement will be realized.

The Mid-Continent petroleum belt is probably as closely observed by the leaders of the industry as any section of oildom. One of the reasons for this is the fact that in all probability the crude and refined products from this region have a wider distribution than the crude and refined products from any other region. The crude situation in the Mid-Continent does not display the vigor which should be in evidence in May, and is somewhat sluggish. No price reductions are anticipated at this time, but there is no evidence of anything that looks like a price advance.

When Mid-Continent crude oil prices were advanced about one month ago, they were evidently increased on the basis of seven and one-half cent gasoline to the refiners. This condition has not materialized, and until this price is in evidence, there seems to be nothing in sight to justify higher crude prices for the Mid-Continent.

Another expansion of a natural gas system was recently announced when the Cities Service Gas Co. stated that their system would be amplified by the construction of 110 miles of ten-inch gas line which will run from Ottawa, Kan., to Sedalia, Mo. This line will make natural gas from the Texas Panhandle and Oklahoma City fields available to another group of Missouri towns in the Sedalia region. Ottawa is an important junction point in the Cities Service system.

Production and Refining Figures Furnished by the American Petroleum Institute

Crude Runs to Stills, Gasoline and Gas and Fuel Oil Stocks, Week Ending April 19, 1930.
(Figures in Barrels of 42 Gallons)

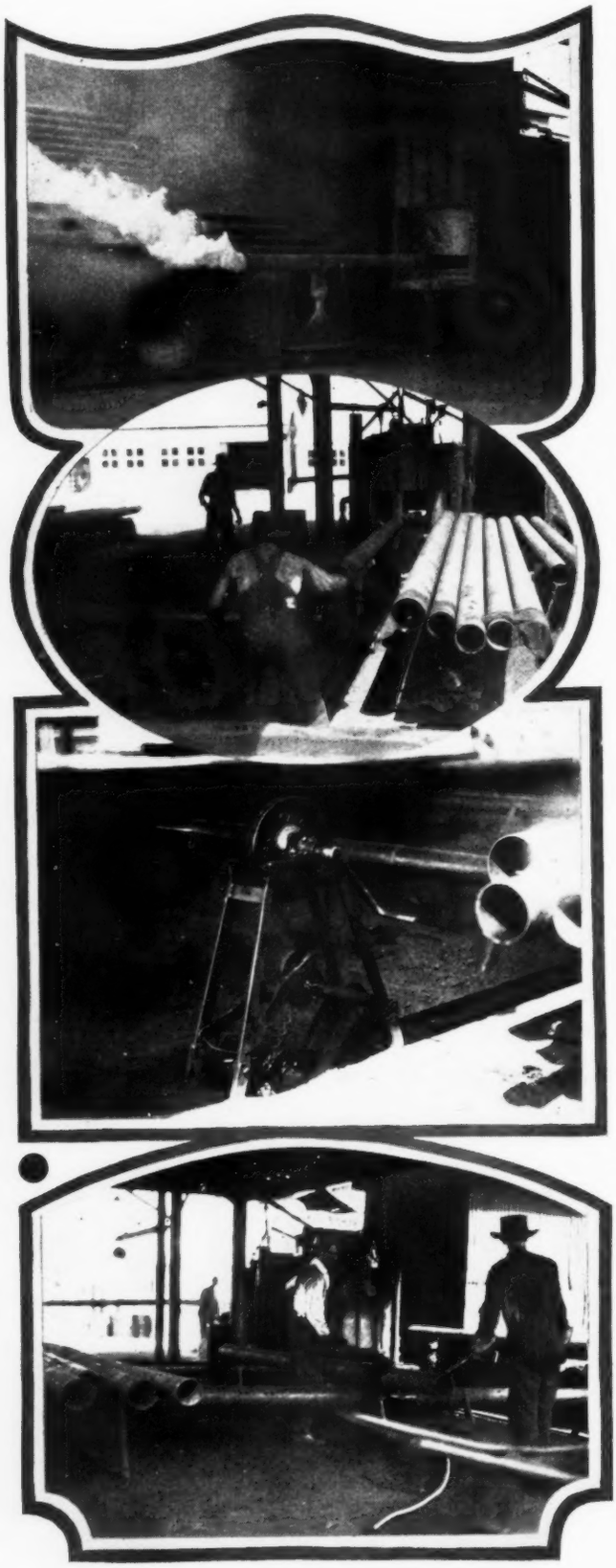
DISTRICT	Per Cent Potential Capacity Reporting	Crude Runs to Stills	Per Cent Operated of Total Capacity Reporting	Gasoline Stocks	Gas and Fuel Oil Stocks
East Coast	100.0	3,170,100	74.8	9,284,000	6,632,000
Appalachian	91.0	614,700	75.3	1,885,000	775,000
Ind., Ill., Ky.	99.5	2,309,900	87.8	8,769,000	3,338,000
Okla., Kans., Mo.	89.1	2,294,500	79.6	4,401,000	3,731,000
Texas	90.4	3,949,000	79.2	7,819,000	10,279,000
Louisiana-Arkansas	96.8	1,177,300	64.2	2,726,000	2,052,000
Rocky Mountain	93.6	415,100	42.6	2,863,000	1,051,000
California	99.3	3,935,200	63.1	15,730,000	108,179,000
Total Wk. April 19	95.6	17,865,800	72.6	53,477,000	136,037,000
Total Wk. April 12	95.4	17,790,800	72.4	53,908,000	135,845,000
The Texas and Louisiana Gulf Coastal figures shown below are included above in the totals of their respective districts:					
Texas Gulf Coast	99.4	2,957,600	80.7	6,792,000	7,675,000
Louisiana Gulf Cst.	100.0	730,900	70.8	2,361,000	1,184,000

Daily Average Production
(Figures in Barrels)

	April 19, 1930	Mar. 29, 1930	April 20, 1929
Oklahoma	658,100	615,000	673,000
Kansas	117,050	314,500	109,100
Panhandle Texas	93,600	89,900	64,050
North Texas	79,350	80,450	83,350
West Central Texas	54,150	51,150	52,500
West Texas	313,950	322,000	357,500
East Central Texas	34,250	25,400	19,050
Southwest Texas	58,800	61,000	72,850
North Louisiana	41,750	43,300	35,600
Arkansas	57,800	58,600	73,500
Coastal Texas	185,700	193,650	131,150
Coastal Louisiana	21,650	20,500	19,300
Eastern (not including Michigan)	128,000	120,000	105,650
Michigan	11,700	11,750	5,100
Wyoming	50,700	50,850	53,650
Montana	10,450	9,300	9,550
Colorado	4,550	4,750	6,400
New Mexico	11,450	11,000	3,350
California	627,900	631,100	796,600
Total	2,560,900	2,514,200	2,671,850

Heating Old Line Pipe *in* Furnace

By J. H.



HEATING old line pipe in a 12-foot blast furnace to burn off paint and prepare the joints for easier cleaning with wire brushes, is a practice that has been followed with excellent results for several years by the Oklahoma Natural Gas Corp., in reconditioning work. The furnace is also used to remove mill scale from new pipe. All types of pipe, with the exception of threaded pipe, is put through this plant.

The layout required for the work is somewhat elaborate, but simple to operate and is equipped with electric lights to permit night work. This feature is advantageous during summer months, affording the crew cooler working conditions on rush jobs. In operation the pipe is drawn through the double door furnace on dollies or horses, operated on trucks drawn by an endless chain. After the temperature of the pipe is raised to the desired degree, expanding the metal and aiding in loosening scale, the foreign material is knocked off with wire brushes. The pipe is then mopped, cleaned with files if necessary and finally painted with a cold primer while warm and dry.

Six men are required to operate the plant which is located at the company's warehouse at Tulsa. A steel frame and sheet roof shed, necessary because of the fire hazard, was built over the layout to permit operation during inclement weather.

As illustrated by the accompanying sketch, pipe to be cleaned is unloaded on a ramp extending to the back end of the furnace. Pipe is rolled to the end of this ramp where one of the crew attaches the double prong hook, fastened to a chain hoist on a swinging boom, to a joint. The joint is swung up and moved with the boom into position to lower on the dollies.

Narrow-gauge rails run through the center and bottom of the furnace. They extend out approximately 20 feet on the back side of the furnace and approximately 40 feet on the front side. The dollies are mounted on small trucks spaced about 15 feet apart. The trucks are attached to an endless chain running down the center of the track. This chain operates on a hand-driven windlass at the end of the track in front of the furnace, and with this the dollies can be moved to any position on the track. The dollies are made of a heat-resisting metal.

When the pipe is loaded on the dollies at the back end of the furnace, the front door is closed and the pipe drawn into the furnace. After that section in the furnace is heated the front door is opened, the remainder of the pipe moved in and the rear door closed. In this manner each half of the joint of pipe is heated in one operation.

In a furnace much longer than 12 feet it would be difficult to rotate the pipe, and unless the pipe is rotated while in the furnace it will sag or warp.

The furnace was designed to accommodate any diameter pipe from 2-inch up to 16-inch. It is equipped with six

Reading top to bottom—A joint going in furnace and emitting sulphur fumes. Removing joint from furnace. Windlass used to pull dollies on endless chain. Mopping dust from pipe.

Assists *in* Reconditioning Work

DAMERON

burners, three on each side. One set of burners is placed higher than the set on the opposite side, in order that all sides of the pipe may be heated uniformly. Each burner has a 1¼-inch pipe in it.

Supplying the blast is a 42-inch blower driven by a 10-horse-power motor. This unit is housed in a separate building adjacent to the furnace, and the air blast goes through a header to each side of the furnace. The old pipe is heated to around 1400 or 1500 degrees. The crew members working on the furnace watch the color of the metal as it heats, and in this manner determine when it has been heated properly.

When the pipe is withdrawn from the furnace two of the crew roll it off the dollies with long bars onto the working ramp built of reclaimed pipe. They knock off all of the rust and scale with saddle brushes similar to those used in casting foundries. The brushes, saddling over the pipe, are fastened in a long brush holder which permits the workmen to move them back and forth over the pipe, and work a few feet away from the heat. Another workman rolls the pipe as it is being brushed.

The brushes are built with a wood base in which the steel wires are set. To prevent burning of the base the brush is cooled and kept wet by having it immersed in a barrel of water when not in use.

After the pipe is thoroughly brushed one of the crew mops off the dust with a wet mop. This has proved a satisfactory method of removing the fine dust, and utilizes idle time of one of the crew members. The water evaporates instantly and cools the pipe to some extent for the next step in the process.

If the joint is badly pitted the two men operating the saddle brush go over the entire joint with files. This method removes the scale from any pit holes which are not cleaned by the brushing action.

While the pipe is still warm it is rolled over the dipping vat. The painter hammers the joint before painting to further remove dust and scale clinging to the pipe as a result of filing.

Formerly the priming paint in the vat was heated. Present practice is to keep a cold primer in pots in the vat and roll the joint over the vat and then apply the primer cold with a brush. The metal is still warm and dry, affording a better bond and better penetration in the pores. After a joint is painted it is rolled out on the stock ramp.

With this installation the company has found that mill scale can be removed from new pipe more easily, which in turn results in a better priming coat on the pipe. The pipe is run through the plant in a manner identical to the method described. The only difference is that the temperature of the new pipe is raised only to 600 degrees instead of 1500 or 1600 degrees, as is the case in heating old pipe. Usually the pipe is allowed to remain in the furnace only long enough to become moderately heated.

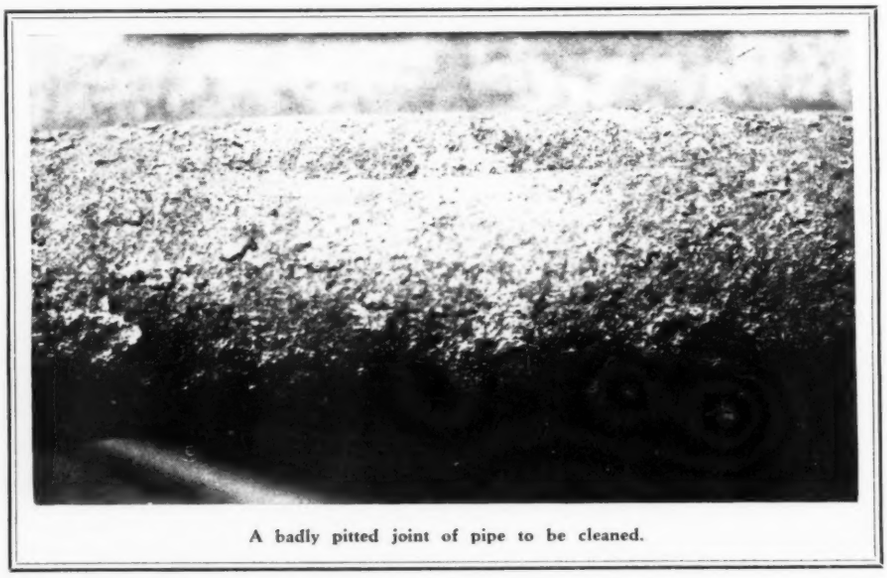
Reading top to bottom—Crew members working saddle brush over joint of pipe, while man turns pipe with shovel inserted in end of joint. Note pile of scale and rust. Painting and filing. Joint of blistered pipe.

The run of new pipe through the plant is more rapid than that of old pipe. The mill scale brushes off readily and it is mopped to remove dust. Filing is unnecessary.

The practice of running new pipe through the plant is considered a test for defective joints. If such a joint is run in it usually blisters and is rejected. Frequently old joints have blistered almost the entire length of the joint, but did not give way under pressure while in service.

After the pipe has gone through the plant and is graded, it is stored in the yards. For the most part the reclaimed material is used to build low pressure lines. Some of the pipe, mostly of large diameter, goes back into high-pressure lines when the wall thickness permits.

Four-inch pipe is the most difficult to work with because it requires more time in cleaning after coming out of the furnace. Last year something like 400 miles of old line pipe was reclaimed at the plant and only recently a plant record was made when 5200 feet of new 2-inch pipe was run through the plant to remove mill scale in a little less than three hours. Two joints were put in the furnace at a time. New pipe, which is heated to remove mill scale, can be run through faster because it does not have to be heated to a high temperature and the scale is easily removed. The following tables give the average time in sending old and new pipe through the plant:



A badly pitted joint of pipe to be cleaned.

Old Pipe

14 joints of	6-inch	hourly
14 joints of	4-inch	hourly
12 joints of	10-inch	hourly
13 joints of	8-inch	hourly

New Pipe

5200 feet of	3-inch	daily
5200 feet of	4-inch	daily
3600 feet of	6-inch	daily
3500 feet of	8-inch	daily
2600 feet of	10-inch	daily

Some pipe, being in a worse condition than others, requires more time to clean after coming out of the furnace. Pipe with a greater wall thickness also consumes more time because of the increased time necessary to heat it.

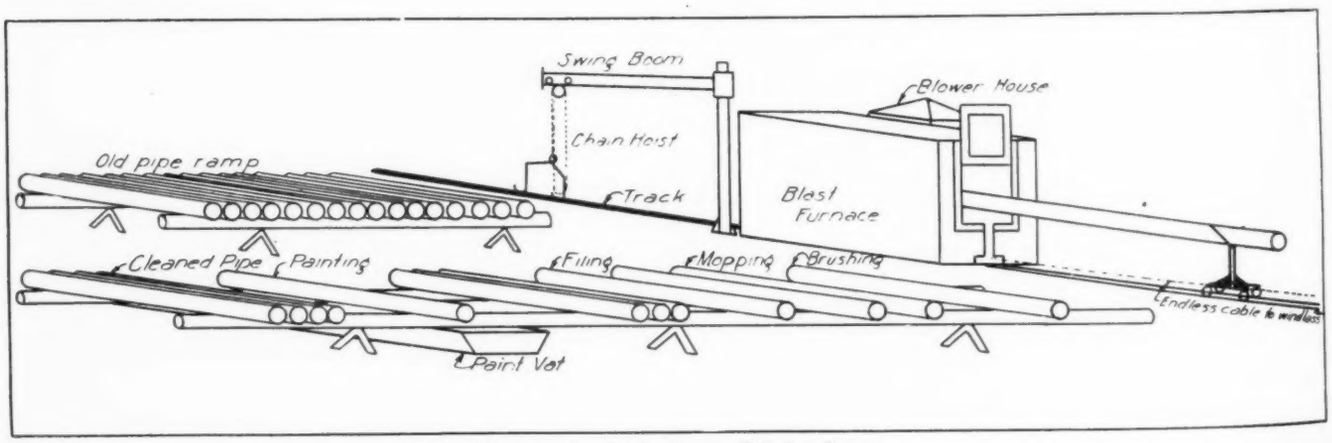
The labor cost is the principal item in the operation of the plant. It is usually operated on a nine-hour day basis and the daily labor bill is from $33 to $35. The furnace consumes around 15,000 feet of gas daily and the power bill to operate the blower is small.

The furnace, of course, had a relatively high initial cost, but its maintenance has been small and the depreciation cost spread over a period of years. The steel shed cost mounts somewhat because that type of construction is necessary. Frequently, a joint heavily coated with a protective coating is run through and the flames from the paint leap high through one of the open doors, so high that occasionally residents living near the warehouse believe the plant is on fire and turn in a fire alarm.

Whenever a rush job for pipe is received a cleaning machine is used to speed up production of the plant. The machine is used as a separate unit and operates independently of the blast furnace. It is used on large diameter pipe which is not coated with protective paint.

The furnace is the only part of the plant which can operate with regularity. The pipe is kept in the furnace only a definite length of time, but frequently bad joints cut down production speed when they reach the working ramp. This is because the joint is exceptionally hard to clean and requires extra time in brushing as well as filing.

Aside from the pipe, little material is cleaned in the blast furnace plant. Valves, fittings, etc., usually are cleaned in a cooking vat containing a boiling chemical solution. Sometimes, however, a few parts are run through the plant when they are in an unusually bad condition.

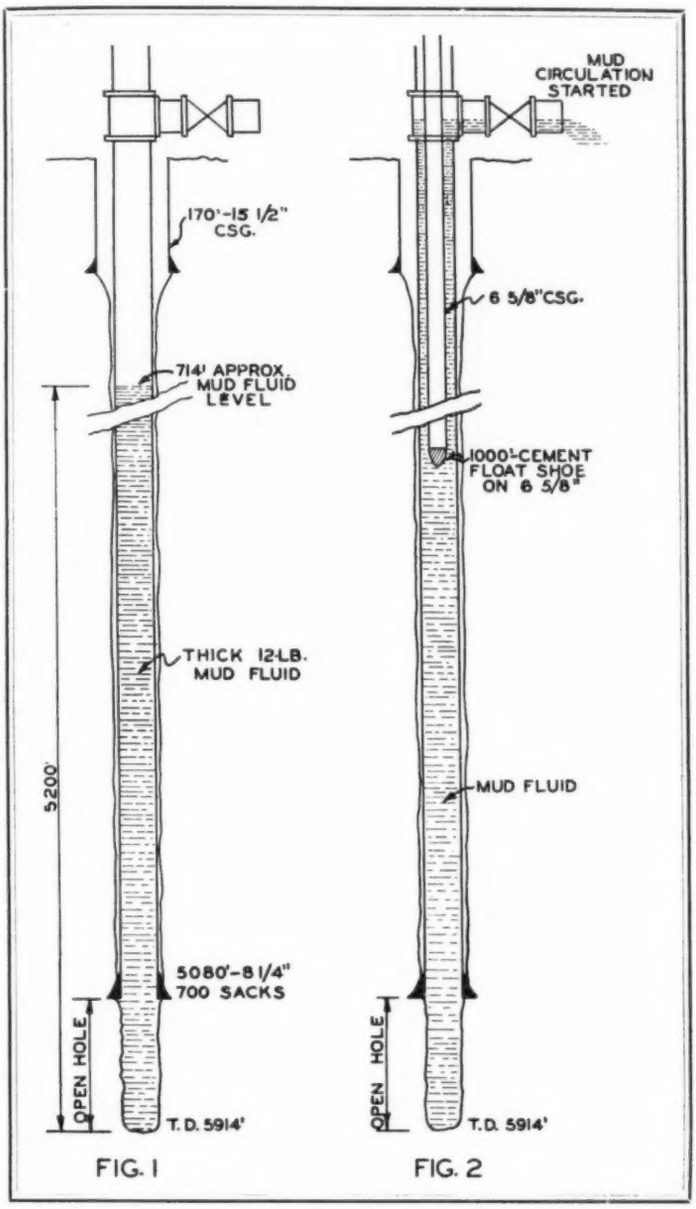


Diagrammatic sketch of reconditioning layout.

How Highly Compressed Mud Fluid "*Froze*" Long String of Casing

By K. C. SCLATER

WHEN a long string of heavy casing is to be run in a well, provision is usually made to float the casing in by the use of float valves and float plugs. In following this procedure, the purpose, of course, is to reduce the stresses and consequent strains in surface equipment and in the upper joints of the casing string; also to guard against damage should the casing part or be accidentally dropped. To expedite running long strings of heavy casing, there are certain important factors that come in for consideration. One of these is the mud fluid. The consistency and weight of the mud fluid have a vital bearing on the speed and successful landing of the casing at the required depth. Every advantage gained by floating in the casing may be lost because of the mud fluid. A somewhat unusual and interesting case in this regard occurred recently in a well of the Gypsy Oil Company near Waketa, in northern Oklahoma.



According to Fred R. Smith, assistant general superintendent for the Gypsy Oil Co., Tulsa, this well was drilled to 5080 feet with rotary tools, at which point the 8¼-inch casing was landed and cemented with 700 sacks of cement. From 5080 to 5914 feet an 8¼-inch hole was drilled with cable tools through the Mississippi lime. This formation, in the area drilled, is so hard that it was not possible to make more than about two feet of hole without running the risk of getting the bit badly out of gauge. In drilling this amount of open hole the drilling fluid became very thick and heavy on account of the dense green shale picked up in the Simpson series. Thus, when the 6⅝-inch was to be run, the hole was loaded with a 5200-foot column of approximately 12-pound mud. A cement float shoe was placed on bottom of the 6⅝-inch casing, but, as this leaked, a cement float valve was placed in the top of the bottom joint. With 1000 feet of casing in the hole, circulation started around the 6⅝-inch. When about 2000 feet of casing had been run in the hole, circulation had become sluggish and eventually stopped entirely. At 5659 feet the casing seemed to pause as it was lowered, but became quite free again and went 20 feet lower to 5679 feet and there "froze." Neither would it go deeper, nor could it be picked up.

In trying to raise the casing, a pull sufficient to produce 72 inches stretch could be applied without freeing it. As nine lines were being used, it was decided, before pulling any more on the casing, to install a weight indicator in order to ascertain the actual load on the casing elevators while pulling. A weight indicator with gauge and recording attachment was obtained by airplane in short order. After attaching the weight indicator to the dead line, 52 inches tension was taken on the casing. According to the gauge reading, this registered a pull equivalent to the weight of about 7580 feet of 6⅝-inch, 24-pound casing. On taking a 72-inch tension the recorded reading indicated a weight equivalent to about 12,850 feet of 6⅝-inch, 24-pound casing. Any inclination to take a further tension on the casing vanished when the magnitude of the pull at 72 inches tension was learned. Instead, it was decided to install a bradenhead on the 8¼-inch casing and try to get circulation down between the 6⅝-inch and the 8¼-inch casing and up through the inside of the 6⅝-inch casing. Water was pumped for some time at a pressure of 500 pounds. This water must have gone back into the formation, because circulation was not obtained. When this failed, the float valve and also the upper half of the cement float shoe were drilled out with a center spear, leaving a 1¼-inch opening through the bottom of the cement shoe. Even after this was done, circulation still could not be obtained. Bailing down inside the 6⅝-

inch casing then was resorted to. When the fluid level was bailed down to about 3000 feet, circulation started. For four hours water was circulated down the outside and up the inside of the 6⅝-inch casing, and when the pipe still refused to budge it was decided to drill out all the cement of the float shoe and to keep up circulation while doing so. Immediately the float shoe was drilled out, the circulation flow increased to such an extent that the water flowed two feet above the top of the 6⅝-inch casing and continued to do so for some time before it fell back. This was caused by the pressure that had been built up below the float shoe and behind the bottom joints of the 6⅝-inch string. Just as soon as this pressure was released the pipe became quite free and could be handled with ease. The casing was then run to the bottom of the hole, 5914 feet.

On landing the casing at 5914 feet, an attempt was made to circulate down inside and up outside the 6⅝-inch casing. Barely five to ten barrels of water had been pumped down inside the casing when the pressure suddenly jumped to 1400 pounds. The pumps were shut down immediately, the bradenhead again connected up, and water pumped down back of the 6⅝-inch casing for ten hours at a pressure of 500 pounds. Again did the formation take the water pumped, so the fluid inside the 6⅝-inch casing was bailed down to 2800 feet off bottom, but without getting circulation. By picking up the casing and working it for some time, circulation broke around the shoe. The hole then was washed clean by pumping down the outside and up through the inside of the 6⅝-inch casing. At this juncture, chunks of mud the consistency of soft putty were observed in the circulating fluid coming from the hole. After the hole was washed clean, circulation was established down inside and up outside the 6⅝-inch casing and continued until nothing but clear water was circulating. The well was then cemented under 500 pounds pressure with 150 sacks of cement. A successful shut-off was obtained and the well subsequently drilled to 6072 feet.

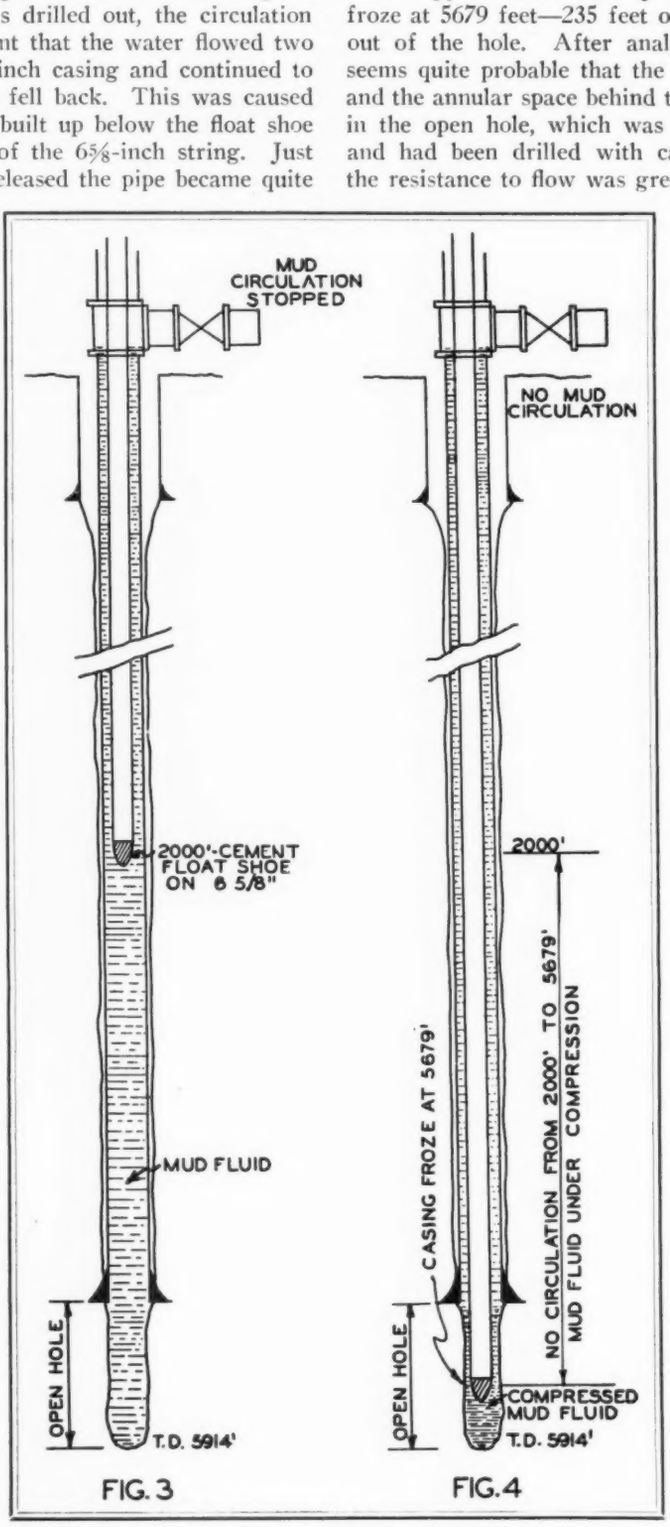


FIG. 3 FIG. 4

This casing job furnished some interesting observations, from which conclusions vitally more interesting were drawn regarding the cause of the casing "freezing."

A column of thick 12-pound mud fluid 5200 feet long stood in the hole when the 6⅝-inch casing was run. The 8¼-inch casing had been landed and securely cemented with 700 sacks of cement. Circulation of the mud fluid was observed to start when about 1000 feet of 6⅝-inch casing was in the hole. According to the amount of space behind the casing filled by the mud fluid, this checks approximately correct. When 2000 feet of casing had been run, circulation stopped. From this point on down until the casing froze at 5679 feet—235 feet off bottom—no mud fluid came out of the hole. After analyzing what had happened, it seems quite probable that the mud was so thick and heavy, and the annular space behind the 6⅝-inch casing—especially in the open hole, which was mostly hard Mississippi lime and had been drilled with cable tools—so restricted, that the resistance to flow was great enough to prevent free circulation, thus building up a tremendous pressure below the cement float shoe and behind the lower joints of the casing string. An interesting and significant result was the compression of the mud fluid to a dense clay below the float shoe and behind the bottom joints of the casing in the open hole. Just how did this come about?

As the casing was lowered circulation gradually increased in sluggishness and finally stopped when the 2000 feet of casing was in the hole. As the casing was lowered still farther, an appreciable pressure was built up below the float shoe. The combined effect of lowering the casing into the heavy mud fluid and increasing the pressure was to expel or squeeze out the water from the mud fluid and push it back into the formation through the walls of the open hole below the 8¼-inch casing. In other words, the lowering of the string of casing with a float shoe into the thick mud fluid was similar in its action to that of a cider, or some such press, squeezing the liquid of a pulpy mass into or through a permeable mass or screen, or into some porous material. This action resulted ultimately in forming a bridge of highly compressed impervious clay behind the 6⅝-inch casing.

Consider this action from another angle. Should the friction in the restricted annular space behind the 6⅝-inch casing be very great when circulating heavy thick mud out of the hole, an extremely high pressure would be required to keep it moving and, should this pressure exceed that required to force water into the formation exposed in the open hole—as it undoubtedly did in this case—compression of the mud fluid would take place and result in squeez-

ing out the water, forcing it back into the formation through the walls of the open hole. It appears that this was exactly what happened. Convincing evidence was the chunks of clay of soft-putty consistency that came out of the hole when circulation was finally established. Further evidence is the fact that water was pumped behind the 6⅝-inch casing at 500 pounds pressure for several hours in a futile attempt to establish circulation. There was no place for the water to go except into the walls of the open hole. The chunks of clay showed distinct evidence of having been highly compressed. It is not likely that this was the result of settling of the mud in the bottom of the hole because, while drilling with cable tools, no trouble was experienced with the thick drilling fluid settling. Even after the well had been standing for a few hours with several thousand feet of thick drilling fluid in the hole, the bailer could be run to bottom every time without difficulty.

When the pressure below the float shoe was relieved by drilling out the float valve and the upper half of the cement float shoe, the circulation flow up inside the 6⅝-inch casing increased immediately, causing the fluid to flow vigorously two feet above the top of the casing for several minutes. From this it is quite apparent that a pressure of considerable magnitude had been built up below the cement float shoe and behind the lower joints of the casing string.

Even when the length of dry casing run in a hole full of mud fluid is much less than the length of string equivalent to the collapsing strength of the casing, it is conceivable that the collapsing pressure of the casing may inadvertently be exceeded. Hence, it is of vital importance to maintain free circulation. In the present instance the timely use of a bradenhead was resorted to and was successful in re-establishing circulation.

Another significant feature of this casing job was the employment of a weight indicator to determine the pull taken on the casing after it "froze." With nine lines it is difficult to estimate the magnitude of the pull taken on the casing. By adopting the wise precaution of installing a recording weight indicator before attempting to pull on the "frozen" string, guesswork was eliminated. Recorded readings, surprisingly large, were obtained. With 52 inches tension a pull of about 91 tons, or a weight equivalent to 7580 feet of 6⅝-inch, 24-pound casing, was observed, and with 72 inches tension 154 tons, or a weight equivalent to 12,850 feet of 6⅝-inch, 24-pound casing. The length of string equivalent to the tensile strength of the joint of 6⅝-inch, 24-pound seamless casing is about 16,270 feet, with no factor of safety.

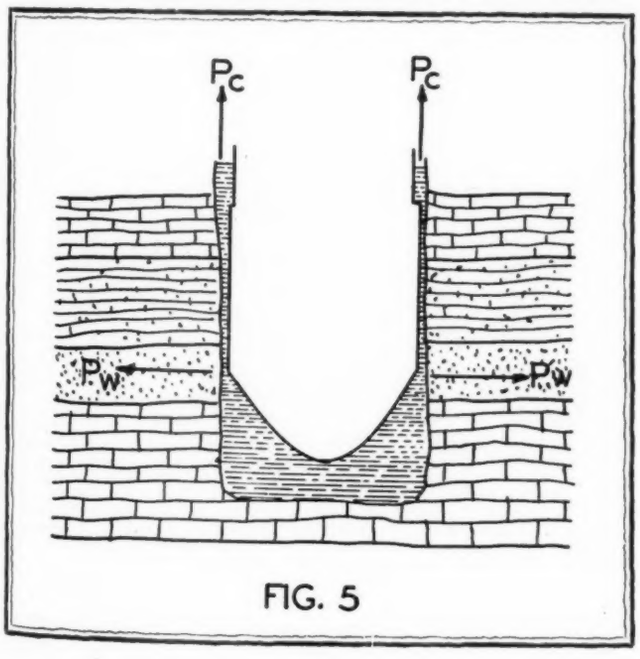


FIG. 5

A wild well in the tropics.

These measurements and figures are quite enlightening. They emphasize the hazards involved in handling long strings of casing, and give some idea of the perplexing problems that occasionally arise in connection therewith. They also emphasize the necessity of installing equipment for positive determination of the amount of pull exerted before any attempt is made to pull on a "frozen" string. It is manifestly impossible to judge the weight pulled with any degree of practicable accuracy unless some type of gauge is employed.

Although one of the main purposes of floating in casing is to relieve the derrick, surface equipment and upper joints of the casing string from excessive strains, the advantage gained thereby may be vitiated entirely by some unforeseen circumstance.

Successful landing of the string of casing in the instance here cited is ascribed to close observation and a correct analysis of the problem, together with the prompt use of a bradenhead and a weight indicator. Of unusual and outstanding interest, however, is the fact that the mud fluid was compressed to a soft clayey mass from which the water had been expelled, then the water driven back into the formations exposed in the open hole. It sheds an interesting ray of light on what may happen when heavy mud fluid is used in a hole of restricted area and with porous formations exposed in open hole.

Refinery Specializes in Manufacture *of* Industrial Naphtha

By F. R. STALEY

INASMUCH as many of the research laboratories throughout the world are studying and developing new uses and products from petroleum, other than fuels and lubricants, it is interesting to note that since the year 1920 the Anderson-Prichard Refinery at Cyril, Oklahoma, has processed for industrial purposes all the naphtha from the crude run in this refinery. The refinery has a capacity of 5000 barrels per day. It operates on crude oil produced from the Cement pool near Cyril.

The crude is distilled in a battery of shell stills, each equipped with a bubble type fractionating tower of sufficient capacity and so designed that great flexibility is permitted in the operation, and the distillation range on each naphtha can be cut to meet the most exacting specification requirements. In addition to the various naphtha cuts, a kerosene distillate and a gas oil are taken off the crude. Since all of the naphthas must meet rigid specifications, special treating equipment and methods have been devised by the company engineers.

Treating

In treating the naphthas, both acid and sodium plubmite solutions are used. The naphtha is treated continuously in closed systems. Baffle type contactors have been designed. The photographs illustrate the two types of treaters used. For the acid treatment, vertical towers are employed with baffles in the lines. For sweetening, a coil type contactor is used in connection with a horizontal settling tank. The quantities of acid required depend upon the product being treated. After distillation, treating is an important operation and demands careful control, since the various specifications cover corrosion, acidity, doctor test and sulphur content.

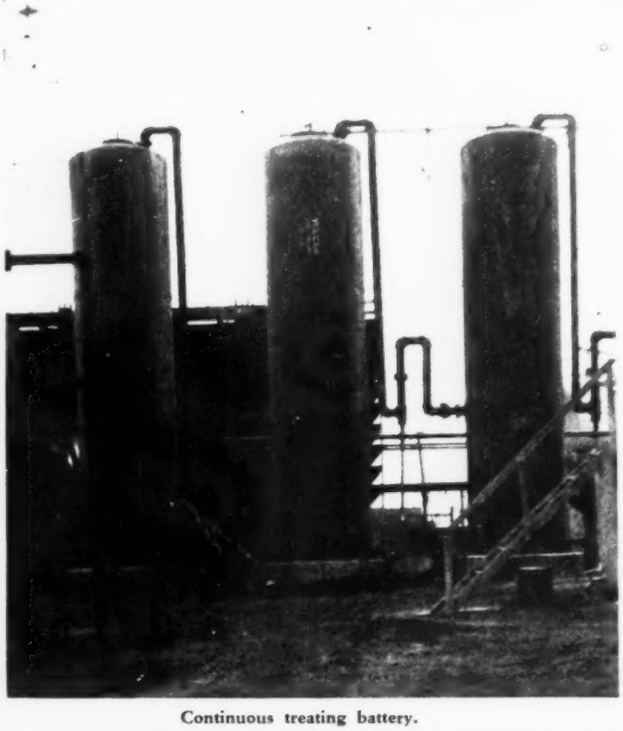
Stoddard Solvent

This company is one of the pioneers in the manufacture of Stoddard Solvent for the dry-cleaning industry, and manufactured such a product before the specifications were outlined and adopted by the Bureau of Standards. One of its special naphthas marketed under the registered trade mark, "Stod-Sol," is used by the dry-cleaning industry in 29 states and in Canada. In the manufacture of this product, the most important property that it must possess is a minimum fire hazard classification. The Underwriters' laboratories classify this product with the same hazard as kerosene, which assures the user a maximum protection.

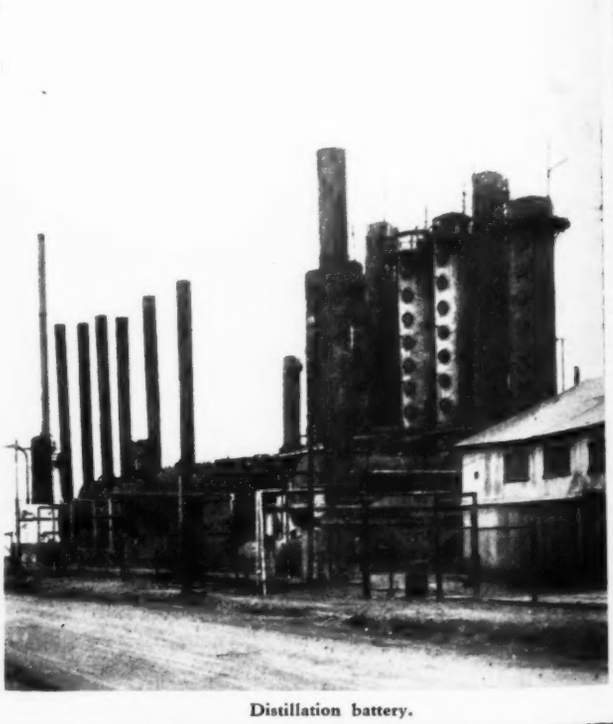
Specifications

The Government Specifications for Stoddard Solvent used in dry cleaning are designated as "Commercial Standards CS3-28." These specifications were developed and adopted as a result of the desire of the dry-cleaning industry to standardize on an efficient product for cleaning fabrics, and to eliminate the loss of life and property as the result of fire and explosions caused by the use of volatile solvents, such as gasoline and benzine. The Government Specifications are as follows:

I. MATERIAL—Stoddard Solvent shall be a petroleum distillate conforming to the detailed requirements given herein.



Continuous treating battery.



Distillation battery.

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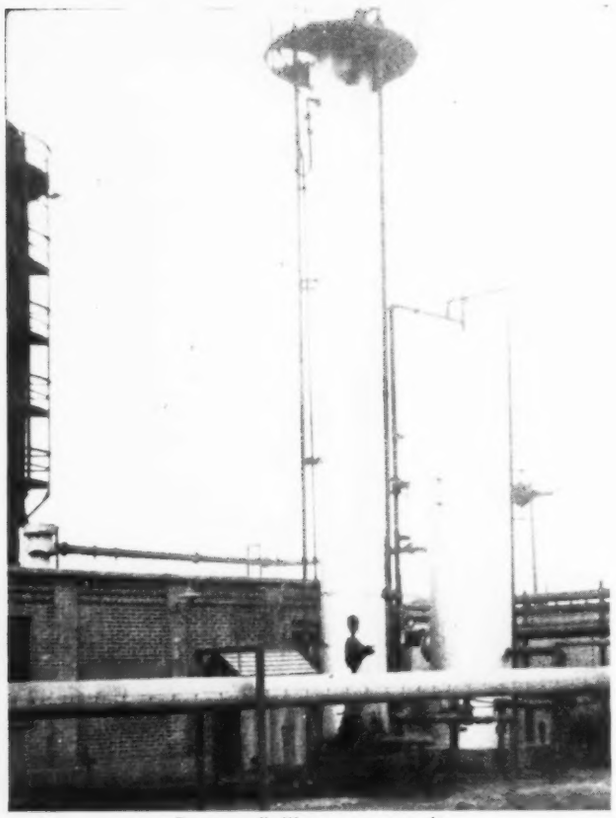


Pressure distillate recovery unit.

II. DETAILED REQUIREMENTS — Stoddard Solvent as received shall conform to the following requirements when tested according to the methods stated in Section III of this specification:

1. APPEARANCE—Shall be clear and free from suspended matter and undissolved water.
2. COLOR—Shall be water-white or not darker than 21 by Saybolt chromometer.
3. ODOR—Shall be sweet.
4. FLASH POINT—Shall not be lower than 100 degrees F. ("Tag" closed tester.)
5. CORROSION TEST—A clean copper strip shall show not more than extremely slight discoloration when submerged in the solvent for three hours at 212 degrees F.
6. DISTILLATION RANGE—Not less than 50 per cent shall be recovered in the receiver when the thermometer reads 350 degrees F. The dry or end point shall not be higher than 410 degrees F. No tolerance shall be allowed above 410 degrees F.
7. ACIDITY—The residue remaining in the flask after the distillation is completed shall not show an acid reaction.
8. DOCTOR TEST—Shall be negative.
9. SULPHURIC ACID ABSORPTION TEST — Not more than 5 per cent of the solvent shall be absorbed by concentrated "c. p." sulphuric acid (specific gravity, 1.835) (approximately 93.2 per cent).

In addition to the specifications, the consumer must consider the cleaning value of the solvent. Various results are obtained from the naphthas of different crude. The National Association of Dyers and Cleaners recommends that cleaners demand and purchase only registered trademarked solvents, and they require the name "Stoddard Solvent" on every delivery ticket.

Rubber Solvent

For several years the Anderson-Prichard Corporation has maintained research laboratories in Chicago under the direction of Dr. J. K. Stewart, to study and develop petroleum solvents for the rubber industry. An office and a bulk station is maintained in Akron, Ohio, in order to give quick and efficient service to the rubber factories.

The company's research work has shown that petroleum solvents have advantages over coal tar products in the rubber industry. Curesol is a special naphtha showing quick penetration and fast evaporation with the desired tack. A new product for the industry called Petrobenzol was developed by the laboratories to replace the older 68 gravity rubber solvent. It eliminates the health hazard caused by rising benzol, and has a narrow distillation range, being less than 56 degrees Centigrade. The ordinary 68 gravity rubber solvent has a range twice this great. The evaporation rate is better controlled, as light fractions evaporate too quickly and heavy ends too slowly for the best results; consequently, a narrow distillation range is desirable.

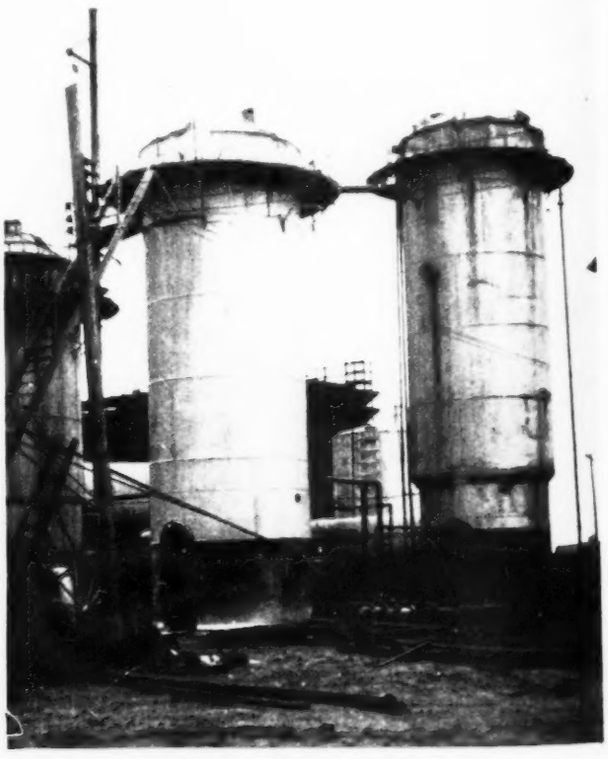
In 1927 the company began the manufacture of a special solvent known as Dip-Sol, which is used in manufacture of rubber dip goods.

The Paint Industry

The requirements of the paint and lacquer manufacturers for special types of solvents in various applications were studied by the research department of the company, and as a result a line of special products was developed. For diluting various kinds of lacquers, three products are refined. They are sold in tank cars or steel drums. One of the service features to the paint industry is the use of the small tank car holding only 4500 gallons.

New Research Laboratory

In addition to the research laboratory in Chicago, the company is starting a new laboratory at the Cyril refinery under the direction of Dr. John Willard, the purpose of which is to work more closely with the refinery to develop new products and methods of refining them to meet the requirements of the various industries which might use special petroleum products, since there are undoubtedly numerous undeveloped uses for specially refined petroleum fractions.



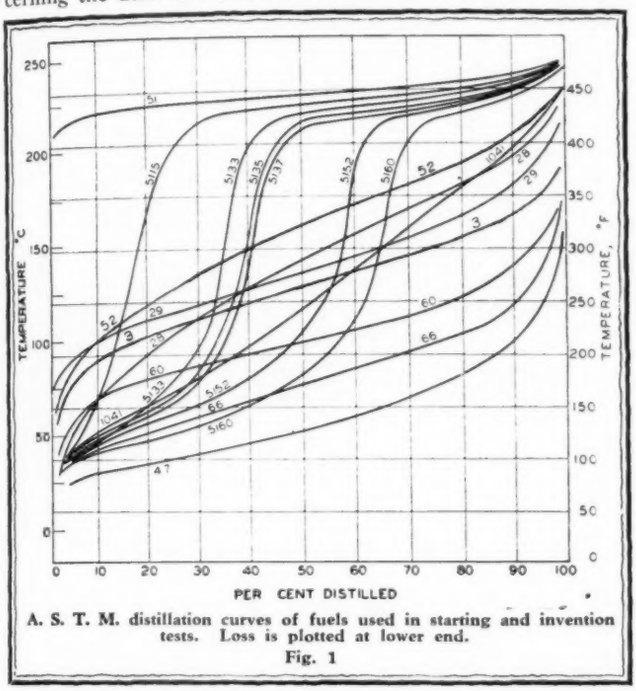
Agitators for treating kerosene.

Determining Motor Performance by » » »

« « Fuel Distillation Characteristics

By GEORGE GRANGER BROWN*

ALTHOUGH there are, in this country, more than 25,500,000 registered automobiles consuming a total of more than 12,000,000,000 gallons of gasoline each year, surprisingly little exact information is available concerning the desirable characteristics of motor fuel from the standpoint of engine performance. It is generally appreciated that volatility is the most important property of a fuel since it determines the ease with which the motor may be started and the manner in which a car responds to the throttle. Knock rating or non-detonating characteristics are also recognized as the second important characteristic of fuels, since this property allows the fuel to give satisfactory performance in motors of high compression. This property is, however, to a limited extent, directly related to the volatility of the fuel.



A. S. T. M. distillation curves of fuels used in starting and invention tests. Loss is plotted at lower end.

Fig. 1

In this discussion the conclusions derived from an extensive investigation of the relationship between motor performance and fuel volatility are summarized and presented in such a manner as to make clear the relationship between the A. S. T. M. distillation characteristics and motor performance. The complete report will be presented before the annual convention of the Natural Gasoline Association of America in Tulsa, Okla., May 21, 1930. It is also available in published form as Bulletin 14 of the Department of Engineering Research, University of Michigan.

Ease of Starting

A series of tests with the fuels whose A. S. T. M. distillation characteristics are shown in Figure 1 over the temperature range from –40 to 80 degrees F. give the results as plotted in Figure 2. The straight line in Figure 2 was derived by Cragoe and Eisinger[1] from tests conducted on a motor equipped with a special fuel jet and cranked by a dynamometer. The data plotted in Figure 2 were obtained from a cold motor cranked by the electric starter supplied from the same battery as was used for ignition, and with the motor equipped with the standard carburetor. These data points fall as close to the straight line as do the original data of Cragoe and Eisinger.

As has been frequently observed, starting was found to be more difficult at low cranking speeds such as 20 r. p. m. than at the higher speeds such as 140 r. p. m. However, when the air-fuel ratio supplied by the carburetor was computed for these different speeds, it was found that the same number of engine revolutions were required for a given air-fuel ratio at the carburetor regardless of cranking speed. Figure 3 indicates the relationship between engine temperature and A. S. T. M. distillation temperature required for a satisfactory start with different air-fuel ratios supplied at the carburetor. The percentages vaporized on the A. S. T. M. distillation at the indicated temperature are given in columns under the number of engine revolutions required to start.

For example, with an engine temperature of 10 degrees F. and an air-fuel ratio of 1 supplied by the carburetor, the ease of starting is indicated by the percentage vaporized in the A. S. T. M. distillation at 140 degrees F.; 6.5 per cent vaporized at 140 degrees F. will allow a start to be obtained in 20 engine revolutions; 7.6 per cent vaporized will allow the motor to be started in 13 revolutions, and 10 per cent

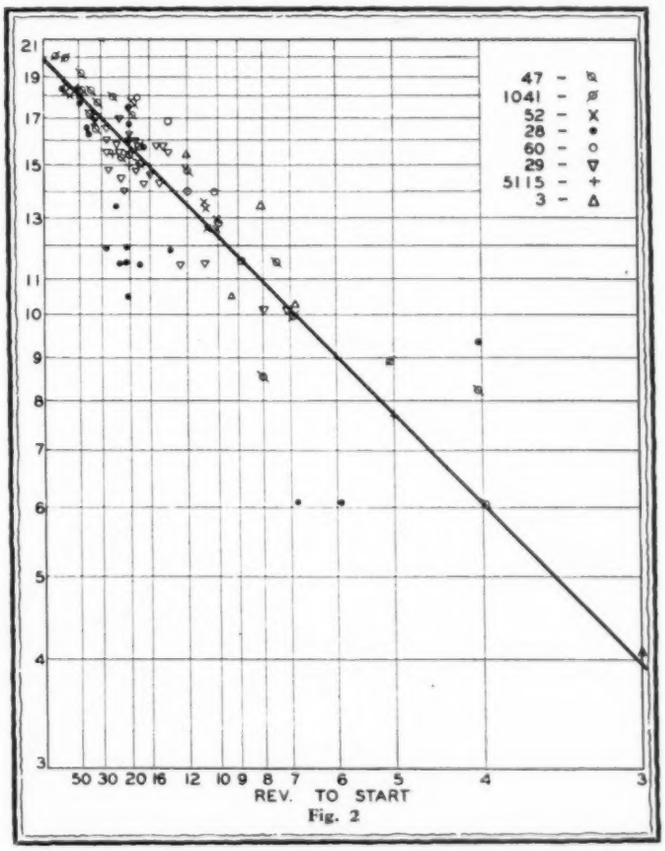


Fig. 2

* Professor of Chemical Engineering, University of Michigan; Director of Research for the Natural Gasoline Association.

[1] Trans. Soc. Auto. Eng., Vol. 22, Part I, p. 1, 1927.

vaporized at 140 degrees F. will allow the motor to be started in 7 revolutions at 10 degrees F. Similarly at an engine temperature of –15 degrees F.; 6.5 per cent vaporized at 110 degrees F. in the A. S. T. M. distillation indicates a possible start with 20 engine revolutions, and 10 per cent vaporized at 110 degrees F. means a satisfactory start with 7 engine revolutions.

Satisfactory Warming Up and Acceleration

As soon as the motor has been started, the manifold begins to distribute some liquid fuel along the walls of the manifold by the drag of the air-vapor mixture flowing through the manifold. When driving at a fairly constant speed along a level road, the velocity of the air-vapor mixture flowing through the manifold is fairly constant, and the liquid deposited on the walls of the manifold at the carburetor reaches the cylinders at about the same rate that it is supplied by the carburetor. Under such conditions the air-fuel ratio supplied to the cylinders is practically the same as that supplied by the carburetor.

During periods of acceleration, however, the amount of fuel delivered to the cylinders immediately after the throttle is suddenly opened is considerably less than that supplied to the manifold by the carburetor. The vaporized fuel carried in the air stream reaches the cylinders almost immediately as does the air. But the liquid fuel flowing along the walls of the manifold moves much more slowly than the air stream and does not reach the cylinders until some time later (usually about 4 seconds). For this reason, during the period immediately after the throttle is opened, the cylinders receive all of the air passing through the carburetor, all of the vaporized fuel, but only that liquid fuel which was being distributed along the walls of the manifold before the throttle was opened.

A mixture ratio of 12 to 1 is required for maximum power. If the air-fuel ratio supplied by the carburetor is 8 to 1, only 66 per cent of the fuel should be vaporized to deliver a 12 to 1 air-fuel ratio at the cylinders, even if no liquid fuel was being distributed along the walls of the manifold. Making a small allowance for the liquid distribution, about 65 per cent of the fuel should be vaporized to give the best acceleration when the carburetor supplies an accelerating charge equivalent to enriching the mixture ratio to about 8 to 1. If the fuel is completely vaporized, an air-fuel ratio of 8 to 1 would be supplied to the cylinders immediately after the throttle is opened. Such a mixture is too rich for maximum power and causes the poor acceleration and loss in power frequently observed when using aviation gasoline in modern motor cars.

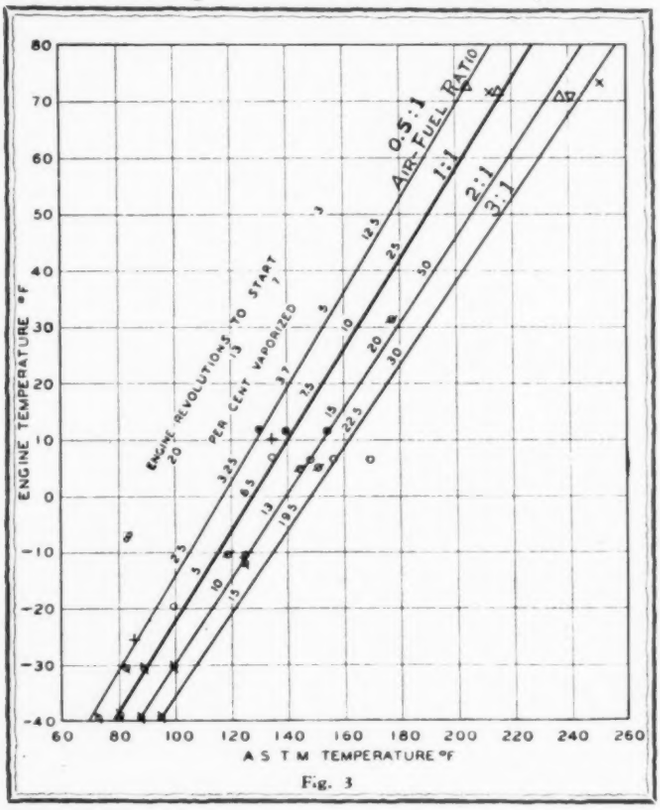
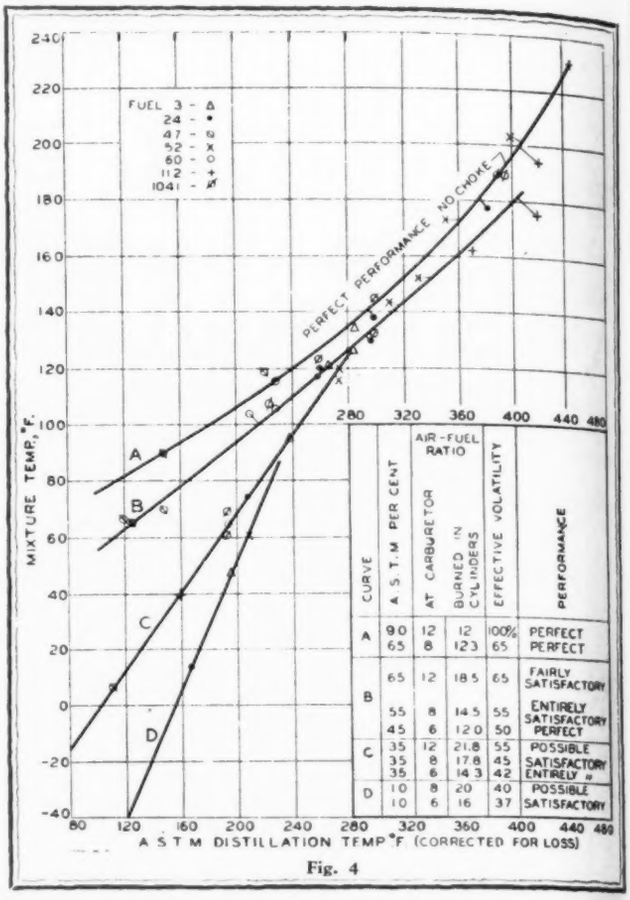


Fig. 3


FUEL 3 - Δ
24 - •
47 - ⊙
52 - X
60 - ○
112 - +
1041 - ✕
PERFECT PERFORMANCE NO CHOKE
MIXTURE TEMP., °F.
A S T M DISTILLATION TEMP °F (CORRECTED FOR LOSS)
CURVE
A S T M PER CENT
AIR-FUEL RATIO AT CARBURETOR
AIR-FUEL RATIO BURNED IN CYLINDERS
EFFECTIVE VOLATILITY
PERFORMANCE
A 90 12 12 100% PERFECT
65 8 12.3 65 PERFECT
B 65 12 18.5 65 FAIRLY SATISFACTORY
55 8 14.5 55 ENTIRELY SATISFACTORY
45 6 12.0 50 PERFECT
C 35 12 21.8 55 POSSIBLE
35 8 17.8 45 SATISFACTORY
35 6 14.3 42 ENTIRELY "
D 10 8 20 40 POSSIBLE
10 6 16 37 SATISFACTORY
Fig. 4

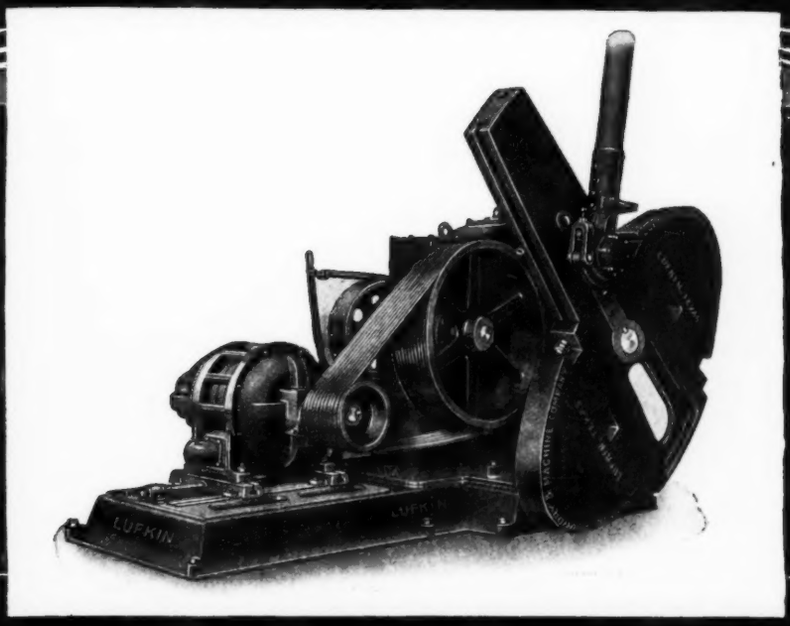
Similar considerations applied to the warming-up period when the choke is usually used to supply a richer mixture indicate that 35 to 40 per cent of the fuel should be vaporized for satisfactory performance under such conditions. It is usually possible to operate a motor with use of the choke on any fuel that will start the cold motor in 10 revolutions or less with a 1 to 1 air-fuel ratio. But with such a fuel it is usually necessary to continually work the choke in order to keep the motor running, while with 35 per cent of the fuel vaporized entirely satisfactory performance can usually be obtained at one position of the choke.

Figure 4 is presented as a summary of the data obtained on a number of different motors, and may be used with confidence, provided only the mixture temperature as it enters the cylinder blocks and the air-fuel ratio supplied by the carburetor are known with reasonable accuracy.

By combining the information contained in Figures 3, 4 and 5, it is possible to estimate with sufficient accuracy for all practical purposes the A. S. T. M. distillation characteristics required in a fuel to give any desired quality of throttle response on the average type of automotive equipment now in use. This has been done in preparing the two tables of suggested fuel volatility for different atmospheric temperatures given at the end of this paper.

Vapor Lock

Some cars heat the liquid fuel as well as the vapor to high temperatures and experience difficulty due to vapor



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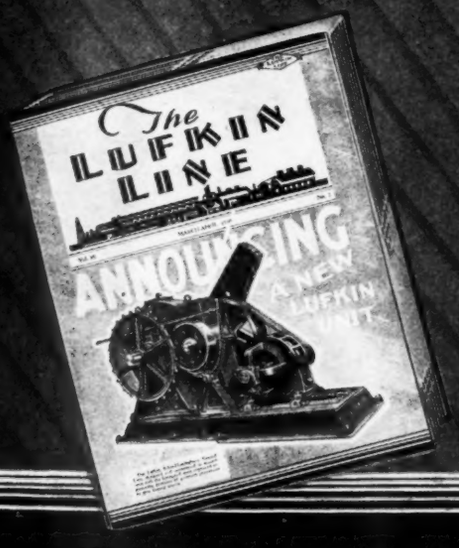

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lock when using fuels of high vapor pressure. The obvious remedy of this condition is proper design of the fuel system to keep the fuel at the lowest possible temperature until after it enters the intake manifold. But as long as such cars are on the road it is necessary that fuel be supplied to give satisfactory performance. Extensive road tests with cars susceptible to this trouble indicate that the probable maximum liquid fuel temperature may be represented by the following expression:

$$\text{Maximum fuel temperature °F} = 100 + \tfrac{1}{2}\ \text{Atmospheric Temperature °F}$$

The tendency of a fuel to form vapor and cause trouble due to vapor lock is measured directly as its vapor pressure. In the complete report relationships between vapor pressure as determined in the Reid bomb and probable vapor-locking temperature are given. For the present, the temperature at which the 10 per cent is vaporiezd in the A. S. T. M. distillation may be taken as a fair approximation of the temperature at which the vapor pressure of the fuel is equal to atmospheric pressure. For this reason the safe minimum 10 per cent temperature in degrees F. may be taken as

$$\frac{100 + \text{Average Atmospheric Temperature}}{2}$$

A. S. T. M. Distillation Characertistic in Terms of Engine Performance

The differences in the fuel requirements of different motors are due largely to differences in mixture temperature and in carburetor metering characteristics rather than in the distributing characteristics of the manifold. For this reason data such as suggested in the following tables may be readily computed by anyone from a knowledge of the air-fuel ratio supplied by the carburetor, the mixture temperature entering the engine block, and the charts given in Figures 3 and 4.

The Relation Between A. S. T. M. Distillation and Motor Performance at Different Atmospheric Temperatures

TABLE I.

For modern motor cars equipped with exhaust-heated manifold hot spot, carburetor with effective accelerating device, and radiator shutters.

Points on A. S. T. M. Distillation With Loss Added at Lower End

Atmos. Temp. (1)	10%		35%		60%		90%	
	Min. (2)	Max. (3)	½ Min. (4)	2 Min. (5)	4 Min. (6)	8-10 Min. (7)	Min. (8)	Max. (9)
80°F.	140°F.	230°F.	235°F.	275°F.	275°F.	320°F.	390°F.	450°F.
50	125	190	200	250	260	310	375	420
20	110	150	175	230	235	290	350	400
—10	90	100	125	210	180	280	320	400

Column (1)—Average atmospheric temperature in which the cold motor is started and operated.

Column (2)—The lowest 10% temperature consistent with easy starting of cold motor, and freedom from vapor-lock with hot motor.

Column (3)—The highest 10% temperature which allows starting and warming up without difficulty under average conditions.

Column (4)—The maximum 35% temperature which allows possible to fairly satisfactory operation without choking about ½ minute after starting, or entirely satisfactory performance with the use of the choke.

Column (5)—The maximum 35% temperature which allows similar operation about 2 minutes after starting.

Column (6)—The maximum 60% temperature giving almost perfect performance without choking about 4 minutes after starting.

Column (7)—The maximum 60% temperature giving perfect performance without choking about 8 to 10 minutes after starting.

Column (8)—The minimum 90% temperature not causing loss in acceleration on warm motor.

Column (9)—Maximum temperatures of 90% now known to be satisfactory under indicated conditions.

TABLE II.

For cars not equipped with radiator shutters, and supplying less heat to the intake manifold, or with carburetor which supplies only a limited accelerating charge.

Atmos. Temp. (1)	10%		35%		65%	90%	
	Min. (2)	Max. (3)	½ Min. (4)	4 Min. (5)	8-10 Minutes (6)	Min. (7)	Max. (8)
80°F.	135°F.	230°F.	235°F.	280°F.	300°F	320°F.	450°F.
50	115	190	190	240	260	250	410
20	100	150	150	200	200	180	390
—10	85	100	100	160	120	120	370

Column (1)—Average atmospheric temperature in which the cold motor is started and operated.

Column (2)—The lowest 10% temperature consistent with easy starting of cold motor, and freedom from vapor-lock with hot motor.

Column (3)—The highest 10% temperature which allows starting and warming up without difficulty under average conditions.

Column (4)—The maximum 35% temperature which allows possible to fairly satisfactory operation without choking about ½ minute after starting, or entirely satisfactory performance with the use of the choke.

Column (5)—The maximum 35% temperature which allows similar operation about 4 minutes after starting.

Column (6)—The maximum 65% temperature giving perfect performance without choking about 8 to 10 minutes after starting.

Column (7)—The minimum 90% temperature not causing loss in acceleration on warm motor.

Column (8)—Maximum temperatures of 90% now known to be satisfactory under indicated conditions.

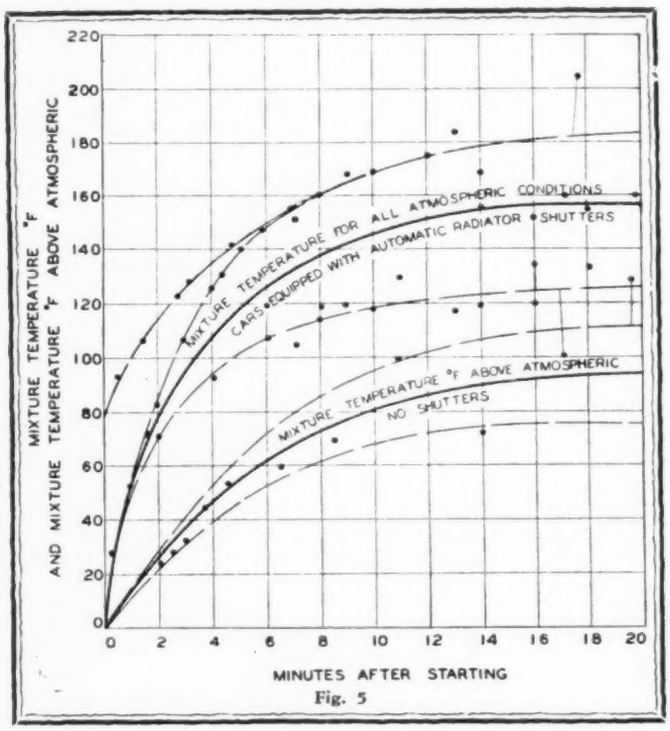


Fig. 5

Several Types of Fans and Blowers Used in

Recirculation of FLUE GAS

By D. F. GERSTENBERGER, *American Refining Properties*

LITTLE has been said of flue gas recirculating equipment as a means of improving refinery operations, yet it deserves much consideration. Its development was primarily for the refining industry, and, like all refinery equipment, it has progressed from a crude and, to a certain extent, rather inefficient piece of equipment, to one of modern design which does its work day after day with very little maintenance expense over a long period of time.

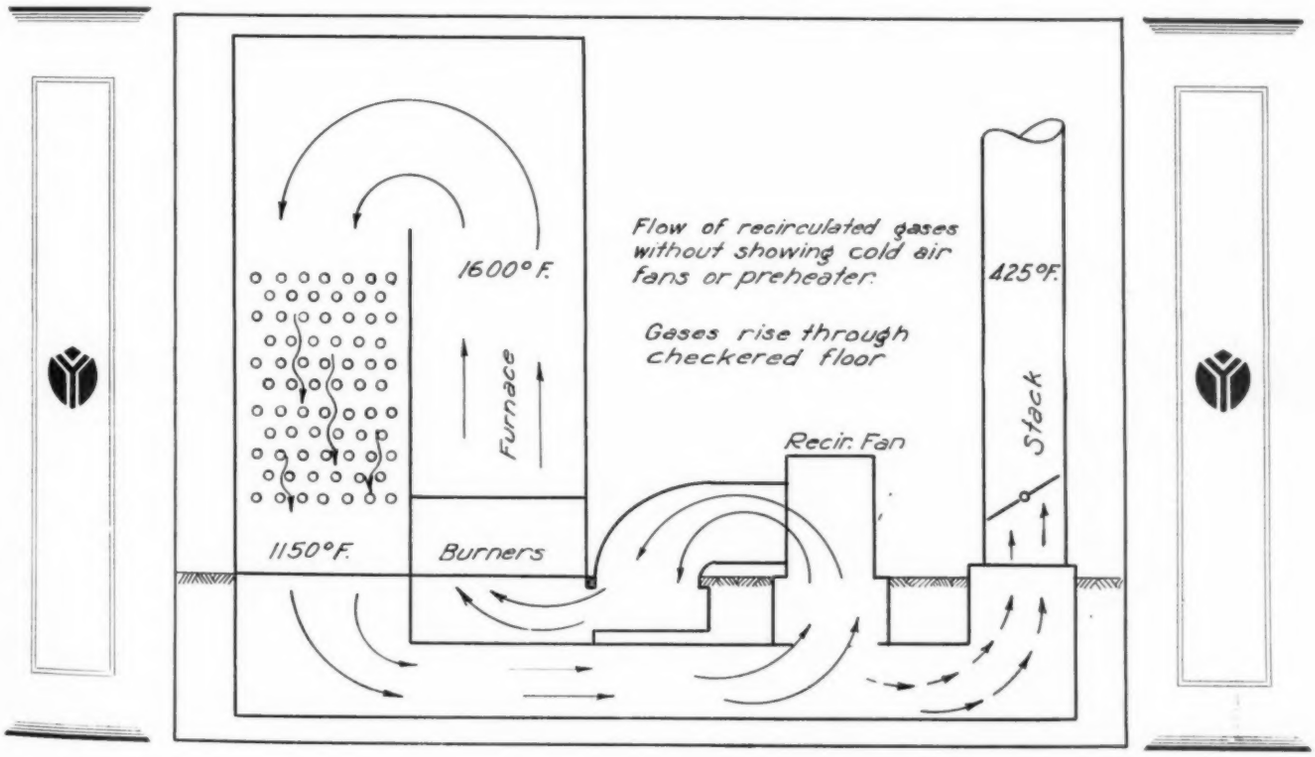
It has been mostly adapted to cracking stills of the tubular design and, in most instances, is indispensable for this work, where, by its use, it is possible to maintain a very high rate of heat transfer, with a minimum amount of surface and with the best possible combustion conditions. It is claimed by many that the saving in fuel alone justifies its use, and there is undoubtedly a great deal to be said for its merits in this regard.

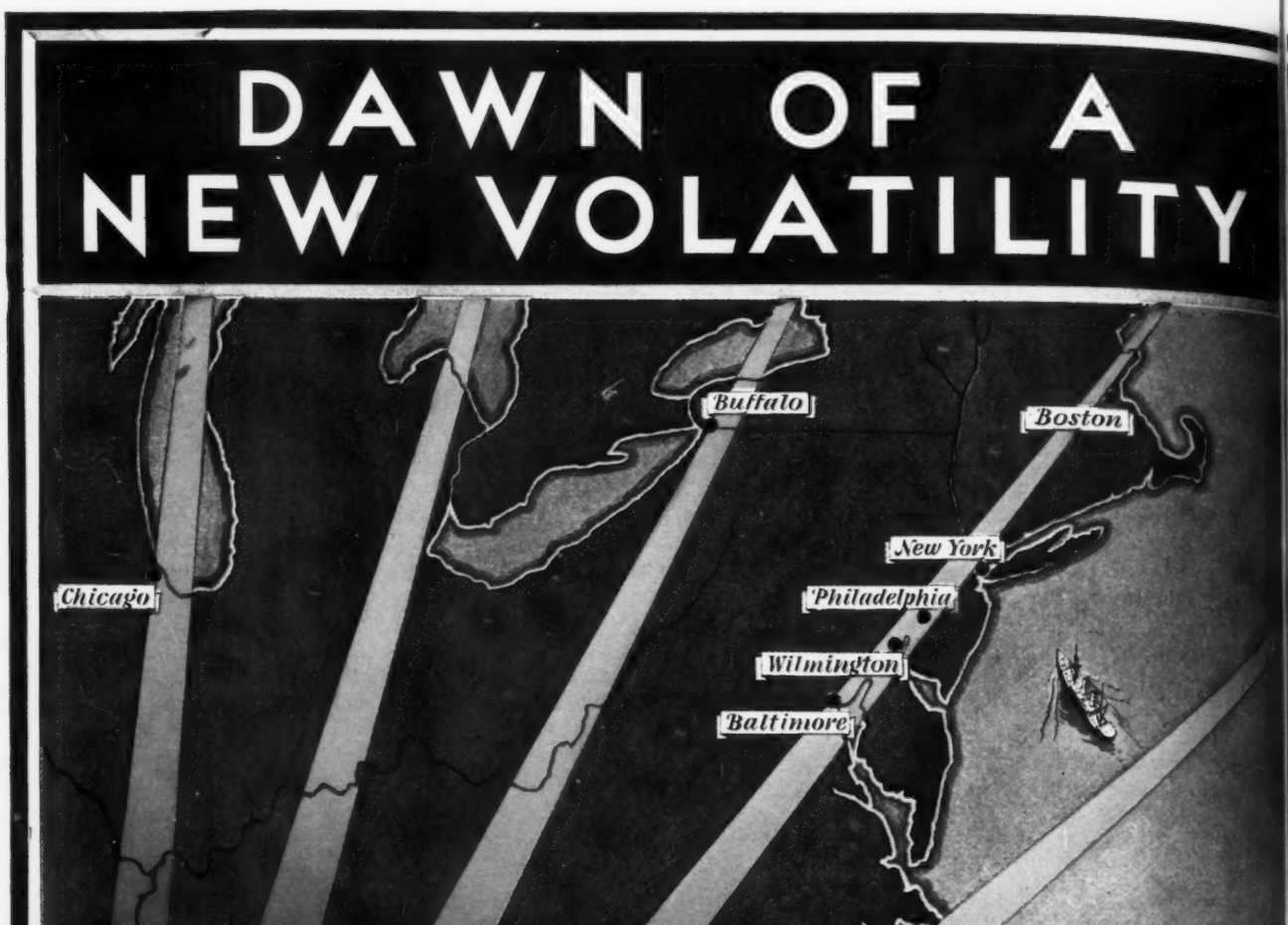
In order to consider the subject intelligently, let us first take up some of the reasons for the use of equipment of this kind. In the early days of the tubular cracking still, furnace conditions were considerably more of a problem than they are today. The first furnaces were built from theory, and theory only. There was no past performance for guidance. To be sure, some of the principles used for certain types of steam boilers were available, but it was soon discovered that the cracking of oil with the attendant destructive distillation, carbon formation, and some vaporization, presented entirely different problems than heretofore had been experienced.

Theoretically, the hottest gases should come into contact with the tubes containing the hottest oil, and the coolest gases with the cooler oil just entering the heating zone. Following this theory, some of the first furnaces built had the cold oil entering the top row of tubes, and passing downward, finally emerging from the bottom row, which was directly over the furnace. The results were rather disastrous. The last few rows of tubes bearing the hottest oil were severely punished from coke deposits and overheating and many tube failures resulted. Consequently, as a means of tempering down this severe condition, the method of oil circulation was changed in this particular type of furnace so that, after the oil had passed downward through about half of the heating surface, it was then started upward from the bottom row of tubes, emerging from the center of the furnace where the severe heat of the gases had been softened, and where the effects of the radiant heat of the furnace were less concentrated. This proved more satisfactory, but furnaces of excessive heating surface and considerable size became necessary. There are many furnaces of this type in use today.

Other furnaces were designed at a little later period which consisted of a combustion space in one-half, and the tubes in the other half. In this instance the gases of combustion passed over the top of a bridge wall and then downward through the tubes. Due to the fact that the tubes were not exposed directly to the radiant heat, this type of furnace was more successful in handling the oil in line with theoretically efficient flow, but the amount of fuel consumed was in most instances excessive.

As the use of preheated feed going to the tubes became more generally used, and velocities through the tubes were thereby increased, both of these types of furnaces proved more satisfactory than they had with cold oil.





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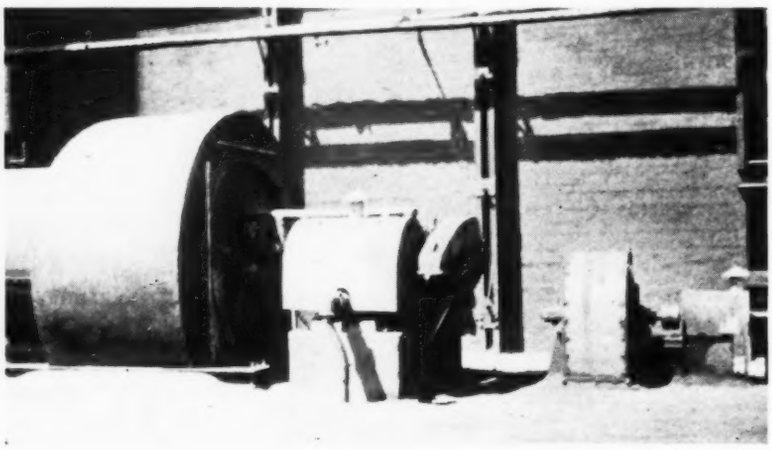
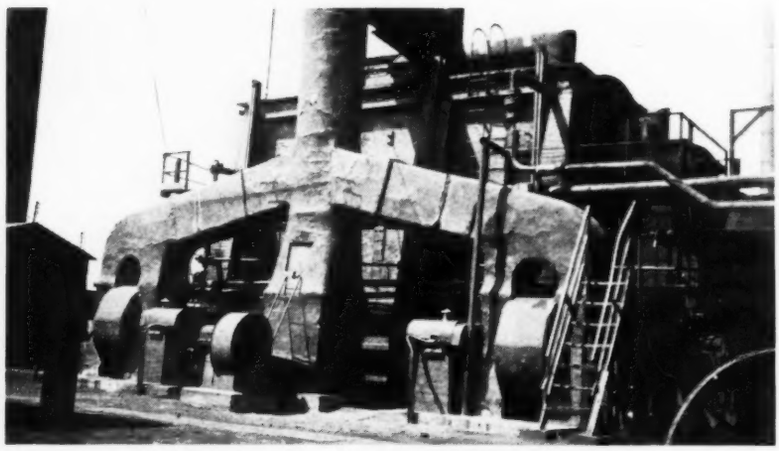
However, it was still realized that most of the work was being done by the few tubes located in the hottest zones, and that in order to properly work the tubes which were absorbing low temperature heat by convection, excess air must be admitted to the furnace, thus causing an increased velocity of gases passing around the tubes. By this method the fuel consumption in some instances mounted up to as high as 14 to 15 per cent of the oil charged through the plant. It was felt, however, that this was justified in view of the increased through-put obtained. During all this period furnace temperatures were one of the main governing factors, 1450 degrees F. usually being considered the maximum for safety as well as reasonable tube maintenance and replacement.



Hot gas fan and one cold air fan on a cracking unit in Texas.



Hot gas recirculating fans and cold air fan on a cracking unit installed in the Mid-Continent.

The apparent advantage of a high velocity of flue gas in the furnace was the incentive to try and accomplish this by mechanical means and further speed up the rate of heat transfer by increasing the speed of these gases. Also it was realized that, by this means, only the amount of air required for good combustion was necessary and fuel economy was bound to result. With these points in view, fans were designed to take the hot gases leaving the furnace and return them into the combustion chamber, allowing only those gases to pass to the stack which were normal to the amount of fuel being burned properly. The lazy preheating tubes were put to work, fuel consumption was reduced and plant capacity increased. Furnace temperatures were raised without detriment to the tubes, and another one of the serious problems of the cracking still had at least been considerably improved, if not entirely solved.

It was soon found, however, that the maintenance of this original equipment was rather expensive. The hot gases warped and cracked the housings and destroyed the impellers of the fans. The principle was correct, but it took years of engineering based on theory governed by experience to work out equipment which would accomplish the desired results and at the same time withstand this severe service. This has been accomplished with no small amount of success as is witnessed by the large number of installations of this kind of equipment in refineries throughout the country. Alloys, impervious to oxidation accompanied by recirculation has been speeded up to further increase the capacity of the stills.

In like manner a 72-4 inch tube furnace on a unit equipped with up-to-date recirculating equipment has a capacity of 1,700 to 1,800 barrels of topped crude per day yielding better than 40 per cent of gasoline. The advantages can well be seen when compared with the original 50-tube 500 barrel per day unit. The pictures accompanying are of this new equipment. Both sets of equipment are motor-driven, and operate with very little attention except occasional inspection and oiling.

There are many marked advantages in the use of flue gas recirculation, which might not occur to one from just casual consideration.

In the first place, where heat transfer is mostly by convection, there is only one other way to even approach a similar high velocity of hot gases around the tubes, that is by excess draft and an excessive amount of secondary air.

By the use of flue gas recirculating equipment, the furnace may be operated at just about a balanced condition, thereby cutting oxidation to a minimum and, in view of the desired high velocity which is attained, the amount of air used is just sufficient for proper combustion, and a decided fuel saving is the result.

The other alternative is to build the still with sufficient heating surface to allow the same heat pick-up at lower velocities and to arrange the flow of oil to keep the tubes in the soaking section from being exposed directly to the intensified high-temperature gases and radiant heat. The cost of such an installation invariably exceeds the cost of recirculating equipment, besides being limited in a great many ways. First is the fact that, due to the increased number of tubes, the resistance to flow is increased and pressures are raised calling for more expensive equipment. Second, most cracking plants today take advantage of all the excess heat possible for preheating and the oil usually enters the furnace at a temperature of at least 500 degrees F. and, in some instances, as high as 800 degrees F. This cuts down the opportunity of picking up any great amount of low temperature heat in the furnace, regardless of the amount of surface. On the other hand, in using the recirculating equipment in conjunction with air preheaters, the utmost can be accomplished with economy in regards to first cost as well as to operation and maintenance.

Specially Designed

Diesel Powered Pump Station

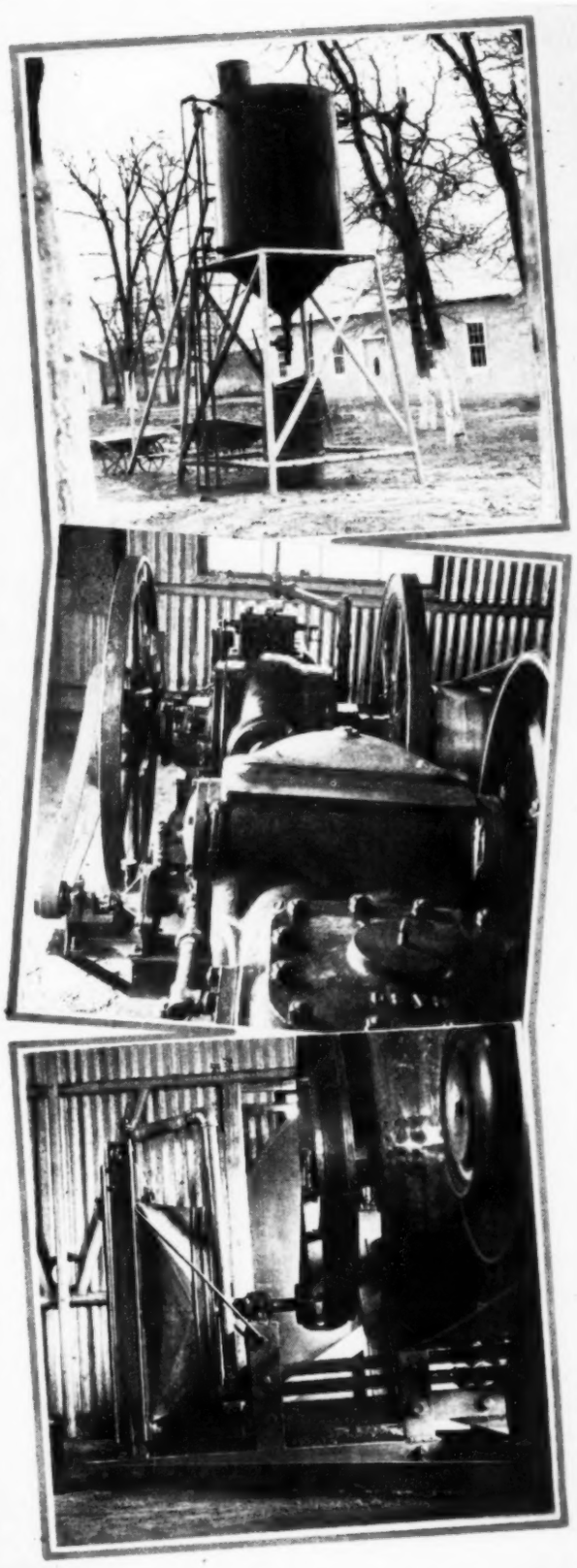
adapted to flush fields

MOVING the flush production in a new and undefined pool and at the same time making economical provision for running the settling production, is a problem that has frequently expanded field station costs to a surprising figure. With all of the help which transporters can muster in arriving at an estimate of the new pool's probable producing limits it is often found necessary to change the location of the field station with a subsequent loss of concrete foundations. This also necessitates changing and redesigning the gathering system. More often it is found that the unit selected to handle the normal runs is much too large. This means either changing the unit or operating the gathering station at a higher cost.

Where electric power lines are within a reasonable distance of the station site, motor-driven units have been installed by some companies. This gives the transporter the opportunity of additional time in selecting the size unit necessary to meet future requirements as well as to reduce initial costs. Several plans to solve this problem are in the experimental stage.

With numerous field station problems in mind, T. R. Lott, general superintendent of the Prairie Pipe Line Co.'s southern division, has designed a light, compact, high-speed Diesel engine unit for temporary field work. The unit is designed to handle 5,000 barrels daily. Among its most advantageous features are, it requires no concrete foundation, no permanent building and no tankage excepting a 1,000-barrel capacity working tank.

Operating at its maximum speed of 850 r. p. m., the engine develops 92 horsepower. However, the engine is usually operated at 650 r. p. m. to drive the 6 by 10 pump, which delivers approximately 5,000 barrels daily against a line pressure of 450 pounds.

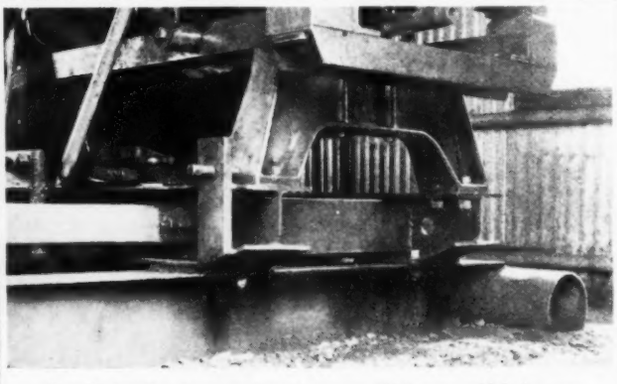


Top to bottom—Cone-bottomed fuel oil tank; detail showing radiator and fan connected to pulley on pump and how it is bolted to the engine foundation; looking down on suction unit, showing detail of water-circulating pump.

This particular unit is adapted to the areas where small pools are found. In Texas numerous small pools have been developed which in their early days indicated a producing area that would require a field station capable of pumping considerable flush production as well as handling a fairly heavy load when the field settled to its normal output. Almost invariably these small pools, after creating considerable excitement, developed into "puddles." The indications in the early development, however, often cause pipe line companies to install field station equipment far in excess of the pool's actual requirements.

There are numerous areas in the states comprising the Mid-Continent where small pools with sizable production are found. In some cases this type of field station assumes a more permanent character and is employed to handle both the flush and settled output of the pool. The equipment on such an installation is set on a concrete foundation to reduce vibration troubles and is operated only a few hours daily. While this unit is semiportable, moving it would cause the loss of a concrete foundation. The original unit was designed to be set up on steel skids and placed in operation with the least possible delay.

The unit can be dismantled and erected in three days' time, and its gross weight, including the steel frame and sheet iron building, is around 15,000 pounds. Both the pump and engine are



Detail showing how engine is set on H beams which in turn rest on skids.

mounted on steel H beams in separate units. The bearing surfaces have been machined and dowel pins are used to bring the two pieces of equipment into line. On one installation the unit was placed on an additional set of H beams built in the form of skids. This permitted a better foundation, gave additional weight, reduced vibration, and made for easier and more accurate alignment.

On the initial run of the unit it pumped around 500,000 barrels of light oil in approximately six and one-half months. It was operated to deliver 182 barrels hourly against a line pressure of 450 pounds. The average time pumped daily during this period was 13.21 hours and the daily average delivery was close to 2,400 barrels.

The engine burned on an average of one barrel of fuel oil for every 2,270 barrels of oil pumped and consumed one gallon of lubricating oil for every 2,090 barrels pumped. On the trial run the maintenance cost was higher than ordinary operating costs. These costs, however, were not due to troubles resulting from vibration.

For a while the fuel problem caused several shutdowns. The engine was found to operate satisfactorily on a fuel ranging in gravity anywhere from 26 to 34 degrees. The oil being pumped averaged around 40 degrees gravity and the fuel for the engine was being taken out of the line in batches.

Unless the fuel supply could be drawn from the line, the unit would lose some of its value as a field or emergency station.

The use of such a high gravity crude caused the plungers in the fuel pump to stick and necessitated a shutdown to clean them. In addition, it permitted foreign matter to clog up the injectors and did not give the lubrication obtained with the use of a lower gravity fuel.

One of the engineers at the station found that a couple of gallons of crank case drainage mixed with the fuel oil every time the tank was filled eliminated the fuel problems. No tests were taken of the oil after the crank case drainage was dumped in the tank.

The fuel tank is a 12-barrel capacity cone bottom overhead tank mounted on a steel frame outside of the building. When a new batch of fuel is put in the tank it is permitted to settle a few hours and the bottom drained off through a valve. The fuel line enters the tank several inches above the drain valve, to permit delivering a cleaner fuel to the engine.

A unique and successful layout was made for the suction pump, which is driven by a 15-horsepower oil engine. This unit, like the larger, is mounted on steel H beams. An old radiator formerly used on a 30-horsepower marine engine was used to cool the water. A large fan was built up on a bracket and used to cool the hot water circulating through the radiator. It was driven by a belt connected to a small pulley fastened to the shaft of the large pulley wheel on the pump. The water is circulated by a small centrifugal pump mounted on the engine frame and driven by a belt operating on a pulley attached to the flywheel. The frame supporting the fan and the radiator is bolted to the beams supporting the small unit.

Some annoyance was expected from vibration, but trouble of consequence from this source failed to materialize on the first run. Early in the test one connection started leaking as a result of vibration. This connection was tightened and, aside from that one instance, no shutdowns from this cause were necessary.

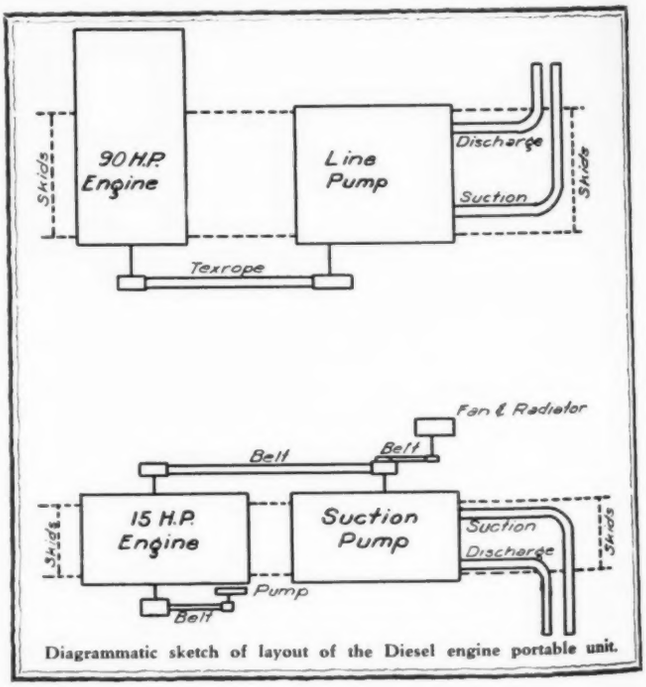
Virtually all of the space in the small building is taken up by the equipment, yet it is so arranged that the station engineer is not too cramped or crowded while working on the machinery. All tools are kept in a large tool box to conserve space, and workmen are protected from the flywheels and belts by portable guards built of small diameter pipe.

The 90-horsepower engine drives a small generator which supplies light for the station building and the small office building adjacent to the pump station. On the opposite side of the engine is mounted a small engine used to start the larger motor. All of the station logs and records are kept in the small office where the telegraph instruments and pressure gauges are located.

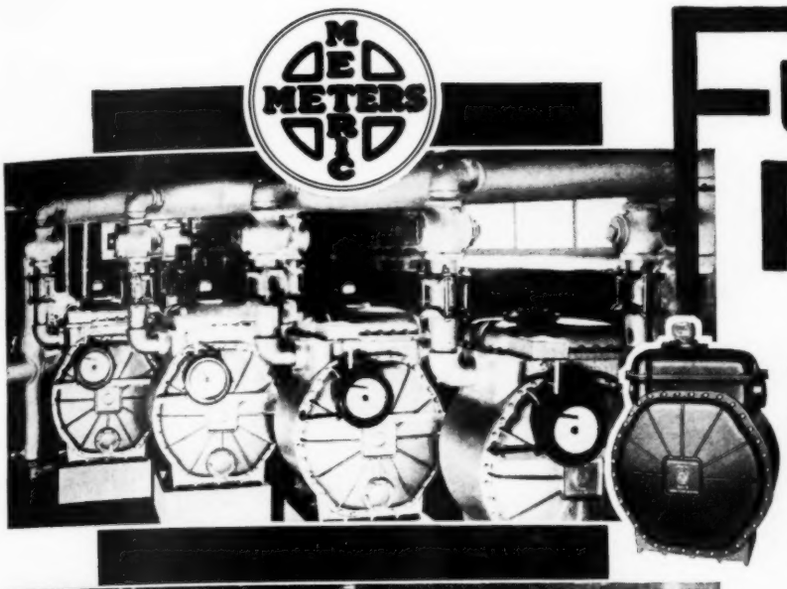
When the permanent station was built and the portable unit shut down, it was closely checked and, in the opinion of machinists, was good for several million barrels additional pumping. The check on engine wear and depreciation was normal and only minor adjustments and replacements were necessary.

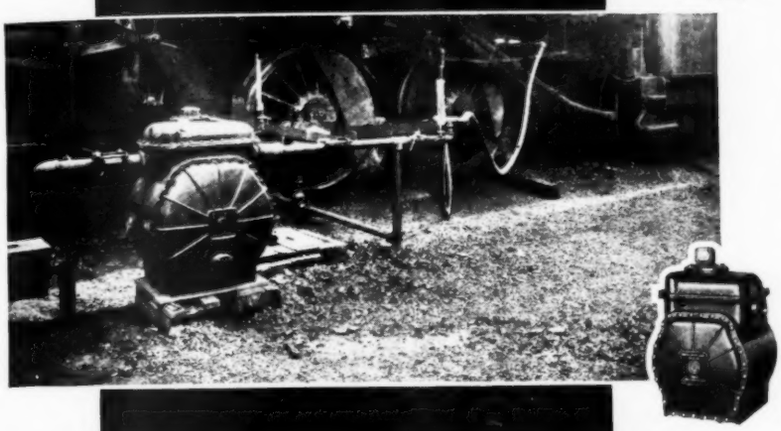
The unit and building were left on the original location and will serve as a reserve unit for the permanent station until it is moved to a new pool.

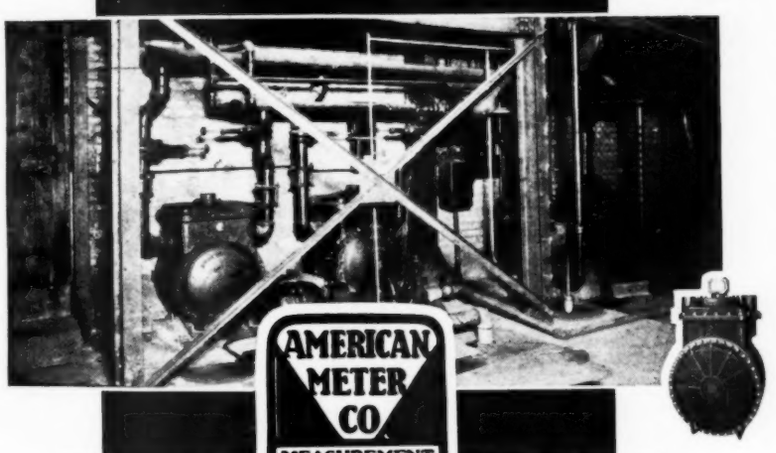
It happened on this installation the unit was set up on a site which later proved ideal for the permanent station. However, had the larger and more permanent type of station been built first, it would have been located approximately two miles south of production to utilize gravity. In all probability a 100-horsepower engine would have been set up and later development permitted the installation of a 65-horsepower engine in the permanent plant.



Diagrammatic sketch of layout of the Diesel engine portable unit.







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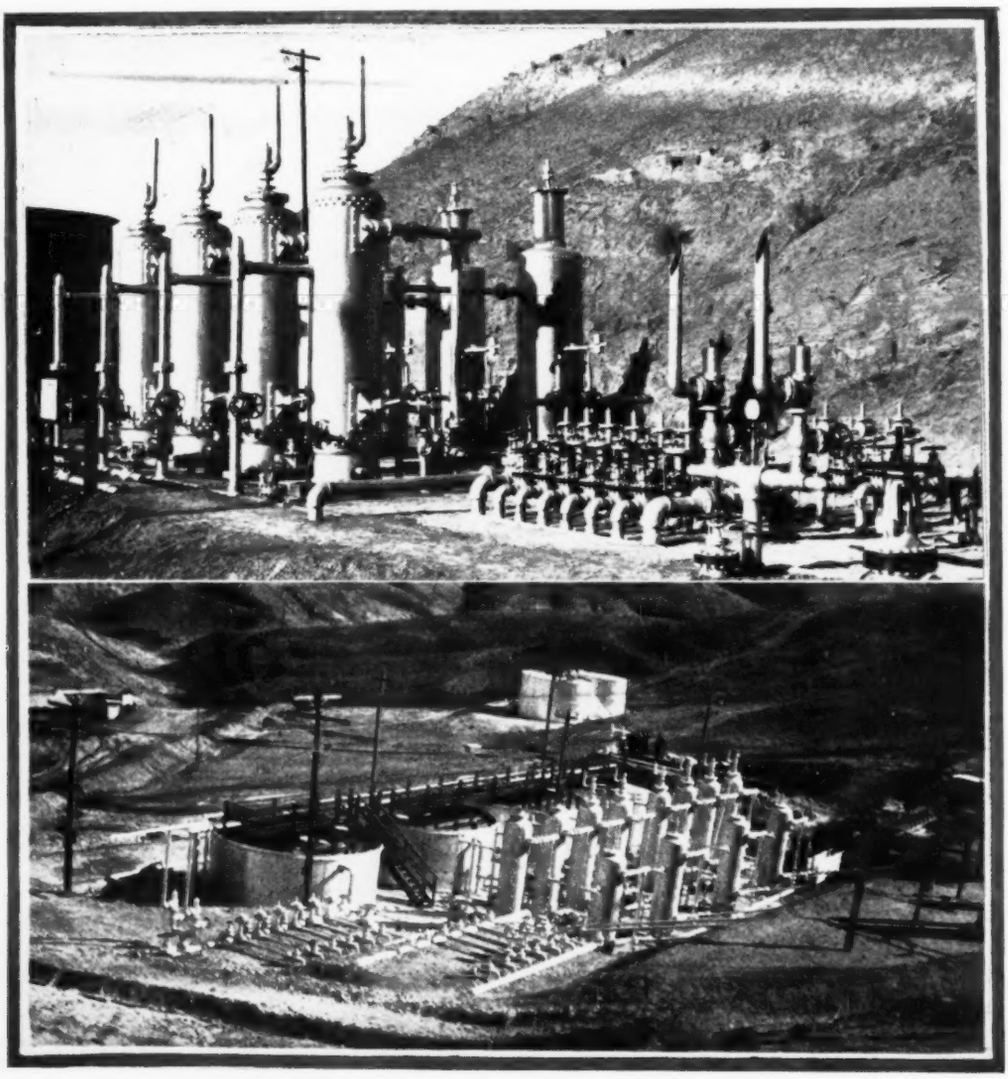
Imperative Need for Stage Separation of OIL and GAS

By R. H. PENCE,
Signal Engineering Company.

THE separation of oil and gas is receiving considerable attention in California with the bringing in of large wells from new deep zones. When small wells were the usual completions not much thought was given the separator, as one of almost any size and strength would do the job in a satisfactory manner, but with the occurrence of large volumes of gas and oil, and high back-pressures necessary to control the well, the separator has become more and more a problem of importance.

Big wells necessitate a considerable expenditure for separators, and this has led to the finding of ways and means to lower their unit cost. Also the need for gas under pressure, usually procurable under natural high pressure, without the huge investment for compressors necessary to obtain such pressure, has been a leading urge.

Experience has shown conclusively that the capacity of a separator is much enlarged when the pressure thereon has been increased because of the compression of the gas to a smaller volume. However, when a separator is operating under high pressure a large amount of gas is held in solution in the oil when discharged from the separator, resulting in a large loss of gasoline revenue. Therefore, the practice has been initiated wherein stage separation is used—that is, the flow from the well is admitted to a separator at a pressure of 200 to 700 pounds, the oil from this separator is then admitted to another separator, hooked in series, and separated at a low pressure; that is, 50 pounds or less. The gas is taken off the initial separator under high pressure, and is transported from the field, or used whenever the need for high-pressure gas arises, such as gas lift, repressuring, high-pressure gasoline plants, and so forth. However, this high-pressure gas is relatively dry because at high pressure the greater portion of the gasoline content of the gas is held in solution in the oil.

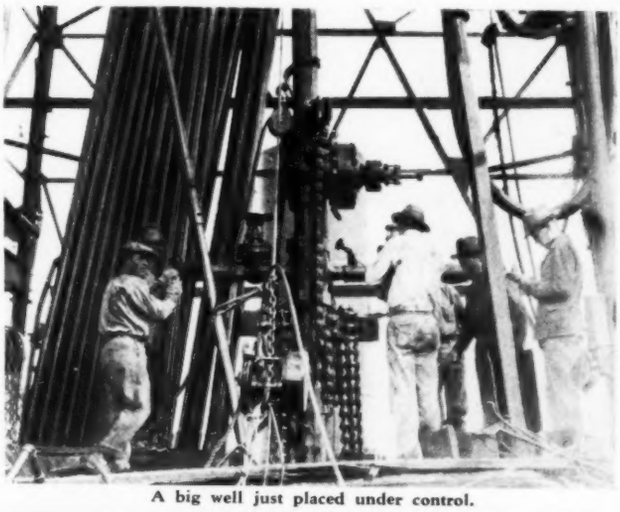


RIGHT — A representative two-stage separator hook-up for one large well.

LEFT — Typical two-stage separator hook-up, Kettleman Hills field.

The gas from the secondary separator goes directly to the gasoline plant, and considerable gasoline revenue is derived from it. If the necessary pressure on the secondary separator is of such degree that considerable tank vapors are noticed, then a third separator has often been an economical procedure. The solubility of gas in oil varies with the particular gas and the particular oil, and no set rule has been found to apply to the third separator proposition. Where it is advisable to install a third separator in series a low pressure is maintained thereon—that is, atmosphere or slightly above—and the small volume of gas is taken from this separator by means of one or more compressors. In every case this third-stage separator is elevated so that the oil will gravitate from the separator directly into the tanks.

The discovery of oil fields like Kettleman Hills, where large quantities of high-pressure gas are encountered, carrying with it a fine spray of oil resembling gasoline, has necessitated the use of stage separation in order to obtain the most efficient separation at a minimum cost. In that field the usual battery of separators has been four high-pressure separators, two secondary separators, and sometimes one third-stage separator. Such an installation is capable of handling as high as 125 million feet of gas, giving good recovery of oil, maximum gasoline revenue, and a large volume of gas under pressures above 500 pounds.

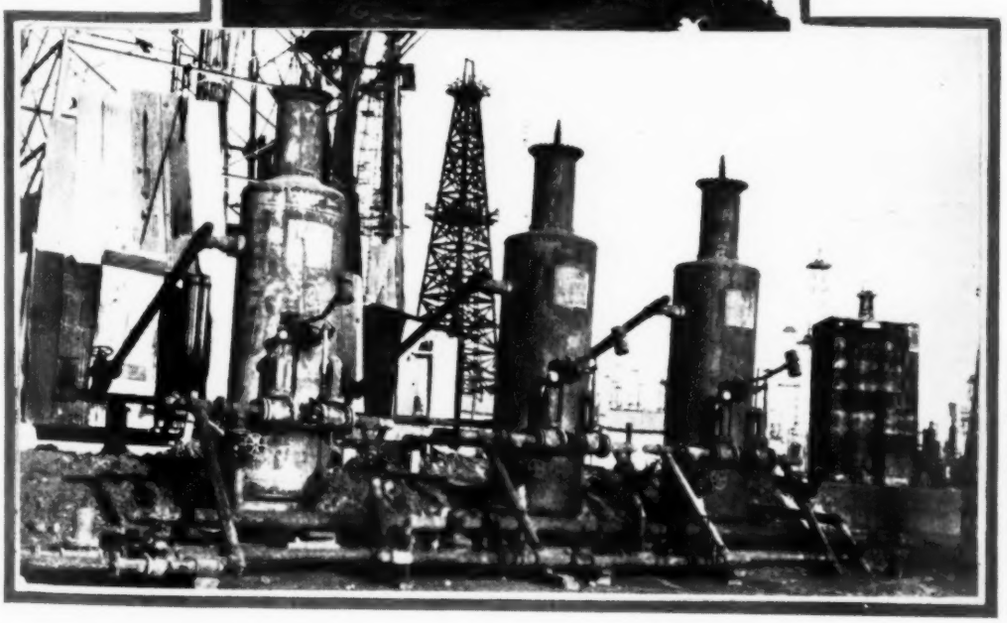


A big well just placed under control.

In oil fields where ordinary pressures occur at the well the use of stage separation has also been found very feasible and a good revenue-producer. Where formerly it was the practice to separate the oil and gas at 50 pounds pressure, it has been proven frequently that the gasoline loss from the tanks has been far in excess of the investment necessary to install two-stage separation. The fire hazard from escaping tank vapors alone has often influenced operators favorably toward the installation of the secondary separator.

All in all, the general trend has been toward high-pressure initial separation. Separator manufacturers have responded wonderfully, and today separators may be obtained with very high working pressures capable of handling more than 30 million feet of gas per separator. Some manufacturers have also added a department to advise the operator as to the best use of separators when his particular problems have been submitted.

ABOVE, right—Two-stage separator hook-up with low pressure unit elevated.



LEFT—Typical single-stage hook-up, showing a number of separators required to handle production at low pressure.

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TELEPHONES were a novelty within the memory of many of us. Yet telephones were common when the first successful commercial treatment for "cut oil" - - - the Tret-O-litE Process - - - was developed. Then lakes and rivers of cut oil were being discarded and giant producing wells abandoned because of salt water. Nowadays, when oil starts cutting, producers call in the Tret-O-litE man as naturally - - - and as confidently - - - as they turn to the telephone when they want to talk to some one at a distance.

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Details Assume Importance In

Treatment *of* Emulsified Production

By R. R. McDONALD [1]

OUR industry is in its seventy-first year. There have been more changes and improvements in the last fifteen years than in the first fifty-six. Competition has become so keen that few companies could operate today under the conditions prevalent as recent as ten years ago. Waste was then widespread, methods slow and awkward, equipment far below present standards. Today waste has been reduced to a minimum. Methods are fast and progressive, equipment superior, heavier of course, and more efficient. What has brought about this great change?

R. R. McDonald.

The cost of producing oil has doubled and trebled due to increase of the cost of equipment for drilling and producing oil from depths of five, six and eight thousand feet, and prices of refined products have not increased proportionately. With the cost steadily increasing and the return remaining the same, the outstanding factor up to now, which has kept a great many companies from going under, is efficiency. There is a factor that is going to play just as important a part in the next ten years as efficiency has played in the past ten. That factor is co-operation.

The old system, literally speaking, was to cut the other fellow's throat. The newer system is to trade ideas, trade methods, co-operation in general for mutual benefit.

If pure oil and distilled water are placed in a bottle in any proportion and violently agitated, then allowed to stand a moment or two, the water will drop to the bottom, the oil will flow on top and a complete separation will take place. Now, allow the cork to remain out of the bottle for a day or two so that a little dust can get into the oil, then cork and shake it and you'll form an emulsion that will remain so indefinitely, depending on the amount of agitation and dust that got into the oil.

Oil is treated to separate out water and B. S. (basic sediment) that have formed an emulsion, making the oil unfit for pipe line delivery.

Three factors are necessary to emulsify oil: (1) Water, (2) emulsifying agent, (3) agitation. By emulsifying agent is meant dirt, fine clay, or foreign matter. By agitation is meant slippage from cut cups, bad balls-and-seats on pumping equipment, slippage during swabbing when swab passes rapidly from one joint of pipe into another. Agitation from gas or oil while producing oil with the air-lift method and the agitation caused by con-

[1] Deep Rock Oil Corp.

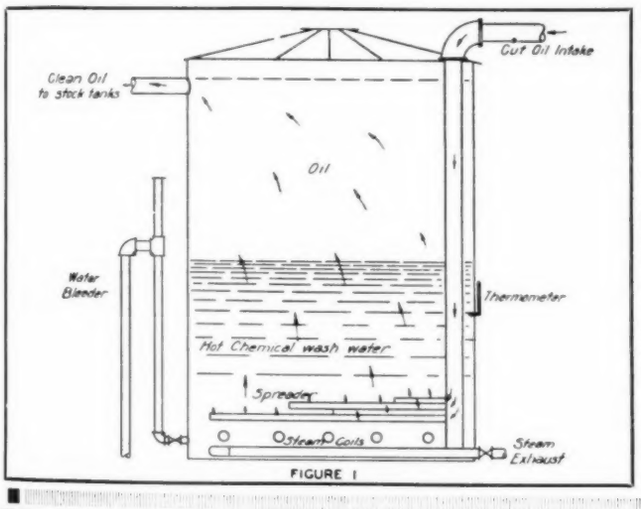


FIGURE 1

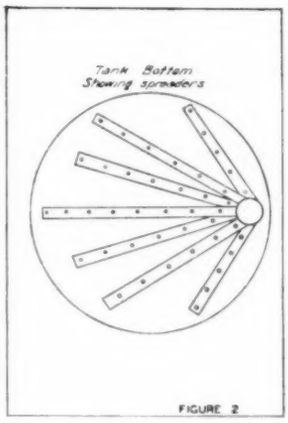


FIGURE 2

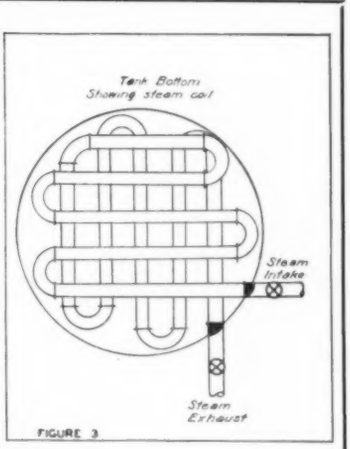


FIGURE 3

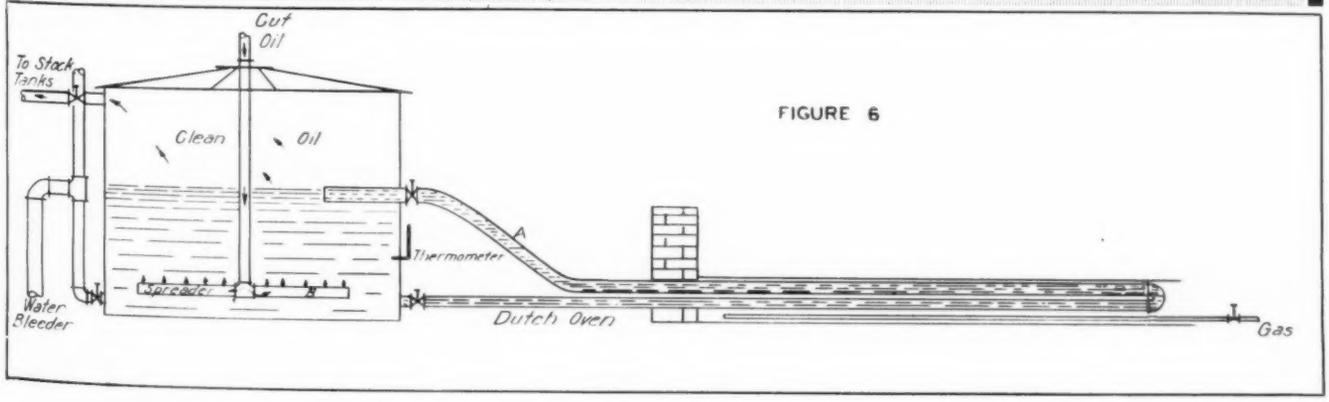
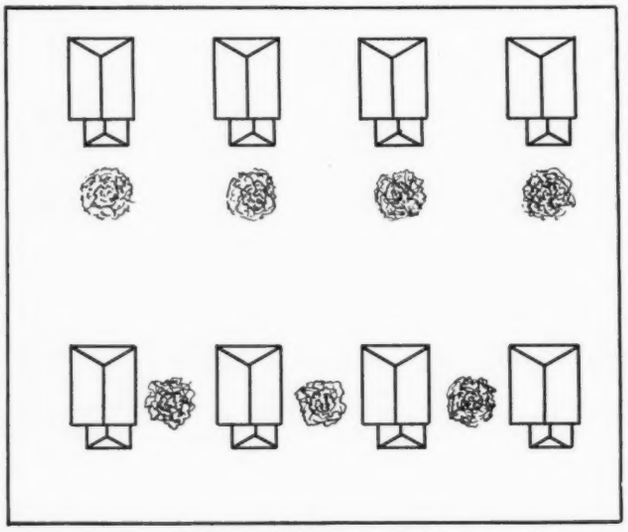


FIGURE 6

tinuing to pump a well after it has been pumped off—the continual churning of the oil.

Emulsions in general come under two groups: (1) "Water in oil emulsion" is most general. Under a microscope you will see minute globules of water suspended in a continuous mass of oil. The smaller these globules of water, the harder the emulsion becomes to break. (2) "Oil in water emulsion." This is the opposite to the above. In this, oil is suspended in tiny globules, water being the continuous mass. Some emulsions break down readily, while others are called tough, meaning stubborn. It is conceded by all that the larger the globules and farther apart they are, the more readily they drop out; while the finer and closer together they are, the harder it becomes to treat them out. These globules measure from one hundred thousandth of a millimeter to several millimeters in diameter. To give you a better idea of the size of these minute drops, a millimeter is one thousandth of a meter; a meter is not quite thirty-nine and one-half inches in length.



MAKING TREES DO DOUBLE WORK.

They're carrying this efficiency thing too far in the oil business. It looks as if they're trying to imitate the packing industry with its slogan, "Nothing lost but the squeal." When an industry can make trees do double duty, it's carrying efficiency a long way, and that's what is being done in the petroleum industry today.

It happened like this: The Deep Rock Oil Co. (formerly Shaffer Oil and Refining Co.) was building a new camp in the Central Oklahoma fields, and one of the company's engineers went to Richard K. Huey, general superintendent, with a plan as shown in the upper portion of the accompanying sketch. There were four houses to be built for the employes, and in front of each house the engineer had placed a tree.

Mr. Huey considered the plan for a moment and then drew a sketch similar to the lower half of this illustration. He had made provision for four houses, but instead of placing a tree in front of each house he placed a tree between each house, thereby eliminating one tree and making the others do double duty.

Under methods of treating oil there are (1) heat, (2) chemical, (3) electrical, (4) mechanical, (5) or a combination of any of them.

Under heat treating, the first and oldest method was sunning. Cut oil was pumped into earthen vats and allowed to settle from the action of the sun. Good oil from time to time was skimmed off the top. This proved most expensive, due to evaporation loss, and, with the lighter ends going off first, gravity was lowered, causing still greater loss.

Next came steaming. This, while expensive also due to volumetric and gravity losses, is not nearly as expensive as sunning. A tank is filled with cut oil and steam turned into it, either raw or through coils. When used raw, sufficient water should be at the bottom of the tank so that the steam will not burn the oil. When used through coils, water should cover them also.

Where there is but a very limited quantity of oil to treat, raw steam may do, as there is little expense in rigging up the treating plant; but where there is any appreciable quantity of oil to treat, installing coils will more than pay for the added cost of material and labor. The steaming plant has a number of advantages. Four thousand barrels can be treated to pipe line requirements in a day in one properly constructed five hundred barrel treating tank, the oil being of high gravity, 39 to 45 degrees. Where there are few stock tanks to allow for settling, you can readily see the great advantage of this method.

Figure (1) gives you the details of this type of treating plant. It is what we call a hot water chemical wash. Figure (2) shows spreader and how cut oil is distributed evenly over the entire bottom of the tank. It then passes up through the hot chemical wash.

On the bottom of a five hundred barrel tank a two-inch double steam coil is installed, the pipe crossing one layer over the other as shown in Figure 3. The intake steam line is one foot higher than the exhaust, which lies on the bottom of the tank. The reason for this is the condensed water will gravity out, while if it were on top some of the efficiency of the steam would be lost forcing it out. Eight feet from the bottom of the tank a siphon is installed to assure a thorough hot water chemical wash for the oil. The next and most important feature of this system is the spreader, Figure (2). This spreads the oil evenly over the

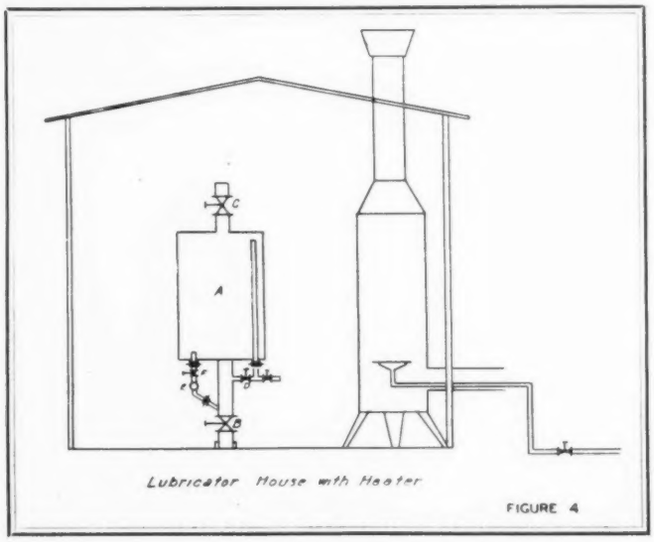


FIGURE 4

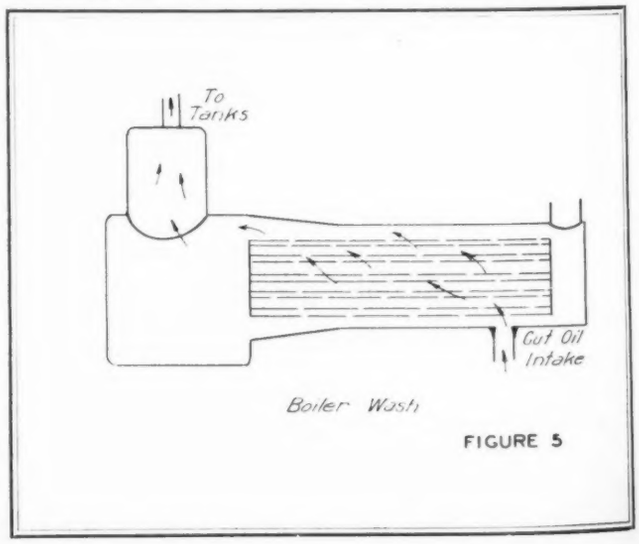
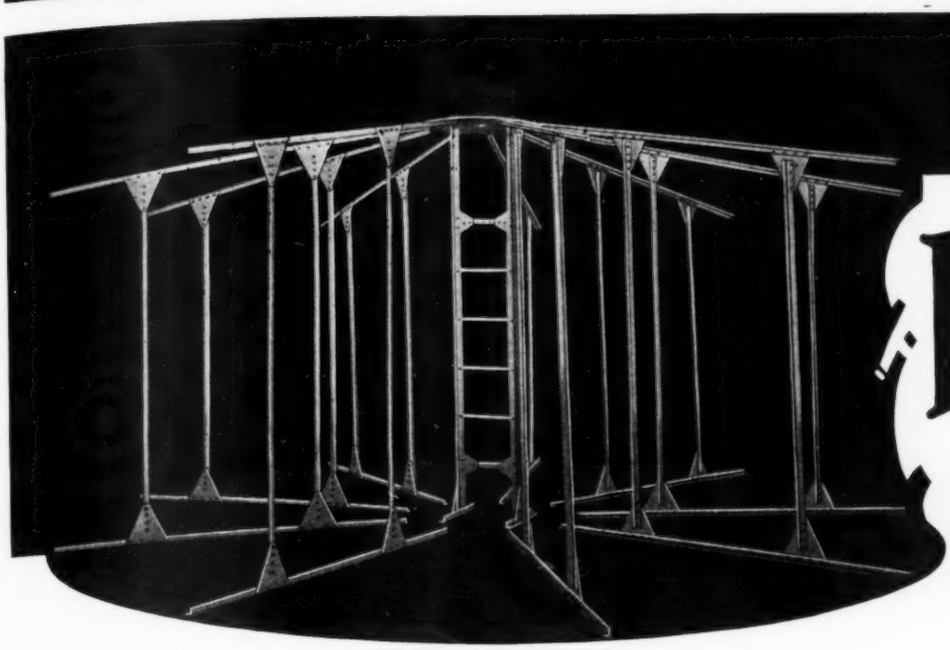


FIGURE 5



Built Like a Skyscraper!

"Trifles make Perfection, but Perfection is no Trifle"

B.S.&B. Perfection Vapor Pressure TANKS

A skyscraper is built on the principles of a human skeleton. There are huge "spines," "ribs," "joints" and substructures to hold the building erect and in shape, and to furnish strength.

The B.S.&B. PERFECTION Vapor Pressure Tank is built like a skyscraper, and is based upon its principles of construction. It's more than a thin shell with one stave supporting the other—each tank is a specific structure and is supported at all points of strain by major braces, cross arms, etc.—*it is structurally correct.* Such points of strength include the angle iron tie rods, reinforced at top and bottom with gussets; the ladder itself, which also serves the same purpose; the bottom angle and top rafter irons; the flanged type staves that circle the tank horizontally, the pie-shaped segmental deck and bottom, and the heat treated bolts with the Chamfered head that stand over 100,000 lbs. tensile strength per square inch.

A tank designed to retain the light fractions of your crude must be built with an abundance of strength in mind to withstand the intensive pressure or vacuum. The B.S.&B. PERFECTION Vapor Pressure Tank protects your crude, preventing evaporation loss and maintaining well-head gravity. The B.S.&B. Safety Valve operates at 16 ounces pressure (which is the ordinary maximum developed by sun rays on quiet crude), or 2 ounces vacuum. Thus the tank automatically protects itself against the unusual pressure (or vacuum).

May We?

Let us tell you more about these tanks, proving their strength and serviceability, and showing how they pay for themselves in the savings on crude and the grade of crude itself. Let us explain our B.S.&B. Service. Send for a catalog or a man to call. There's one near you now! Address Dept. C-14.

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Fig. 6A. Dutch oven on Deep Rock lease near Bristow.

bottom of the tank one foot above the steam coils. Without this, if oil were to come out of but one pipe it would rise in but one place tending to cool the water bath there without thoroughly washing the oil. A thermometer is put on the outside of the tank through a flange, its bulb being in the water gives at all times the temperature of the bath. Two feet from the top of the tank is the overflow out of which comes the washed oil to go to the stock tanks for pipe line delivery.

Features of this system:

1. Spreader distributes oil evenly through the hot chemical wash.
2. Oil washes through seven feet of hot chemical wash, chemical having been introduced through lubricators (Fig. 4) on the flow line before the oil reaches the treating plant.
3. Washed oil has seven feet of room in which to drop out all BS and water.
4. This plant handles a hundred and fifty to two hundred barrels per hour.
5. Oil to be treated coming in at the bottom, at from five to eighty per cent BS, goes off the top at pipeline requirements.

The boiler wash is very similar, except that a boiler is used instead of the five hundred barrel tank. This operates as efficiently, but will not handle the volume of emulsion as the five hundred barrel tank plant. Also stock tanks are required for settling purposes with this system.

The third commonly used treating plant is called the Dutch Oven (Fig. 6). Water boils in the heater and rises through two-inch pipe (A) into tank. This starts a continual circulation of hot water through which the cut oil is washed from spreader (B) rising through hot water with chemical and going out at (C) to the stock tanks. This is for small production only and little expense is involved.

Before leaving this subject of heat treating, it is well to consider the following table showing volumetric and gravity loss from heating oil:

Average Temp. in Degrees F.	Bbls.	Volume Per Cent	Amount Lost	Gravity Lost Degrees A.P.I.
84	300	1.76	5.3	.65
105	300	3.30	9.9	1.10
125	300	5.45	16.4	1.55
150	300	6.70	20.1	1.99

The above tests were made on El Dorado, Kansas, oil, of 37.5 degrees gravity by J. H. Wiggins. With the above figures known it seems foolish to treat with heat.

Chemical Treating.

In the chemical treatment of oil, a lubricator such as Fig. 4 may be used. (A) is filled with chemical after valve on flow line is closed. When lubricator (A) is filled, valve (C) is closed and valve (B) is opened. Valve (D) is then opened and pressure from flow line equalizes, allowing chemical to drop through sight feed (E) to the required amount which is regulated by valve (F). These lubricators are condemned by many because the older ones were made with ¼-inch connections and would clog up. This trouble has been overcome by using ⅜ or ½-inch connections. They are used on flow lines and can handle from one-half gallon to twenty gallons of chemical per day, depending on their size and how often they are refilled. They are inexpensive and since there are no wearing parts little upkeep is necessary. Old ten or twelve-inch casing is used to make them where great pressures are not to be encountered. The only disadvantage of this type of equipment is that when it is regulated to deliver a certain amount of chemical per hour, a change in atmospheric temperature changes the amount delivered, due to the viscosity of the chemical changing and becoming heavier. In winter it is necessary to build a small house over it, heated, in order to keep the flow of chemical steady day and night. Too much cannot be said about the care taken in building this house with heater over the lubricator. The heater must be constructed so that there is no flame in the house. Were an accident to occur, or part of the lubricator break, oil and gas would escape, ignite and probably cause great damage. A good heater to use is one welded with a long nipple protruding through the wall of the house. It is lighted from the outside, its chemney protruding through the roof carries fire out of the house so that gas or oil escaping could not possibly ignite.

One of the most efficient methods of introducing chemical into a lead-line is through a chemical proportioning pump which works from the reciprocating movement of the walking-beam (Fig. 7). This, a small pump, is set between the Sampson and Headache posts. The pump handle is connected by a stout wire to the walking-beam above. It pumps chemical into the lead-line or down the hole, as the case may be, only during the time the well is being pumped. When it is once regulated the flow remains the same as the stroke remains the same from the walking-beam. These proportioning pumps cost very little.

The newer method of treating down the hole is proving

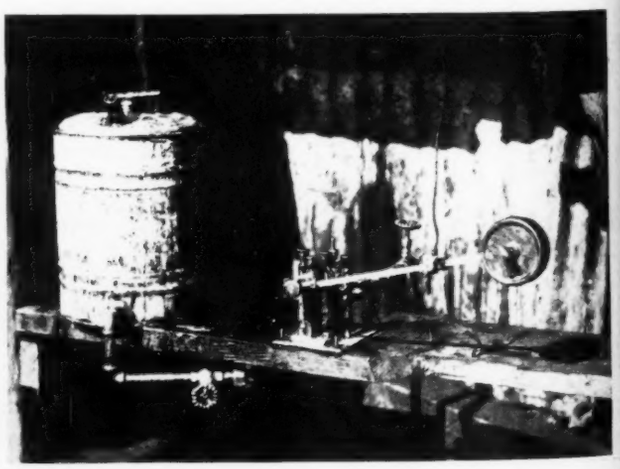
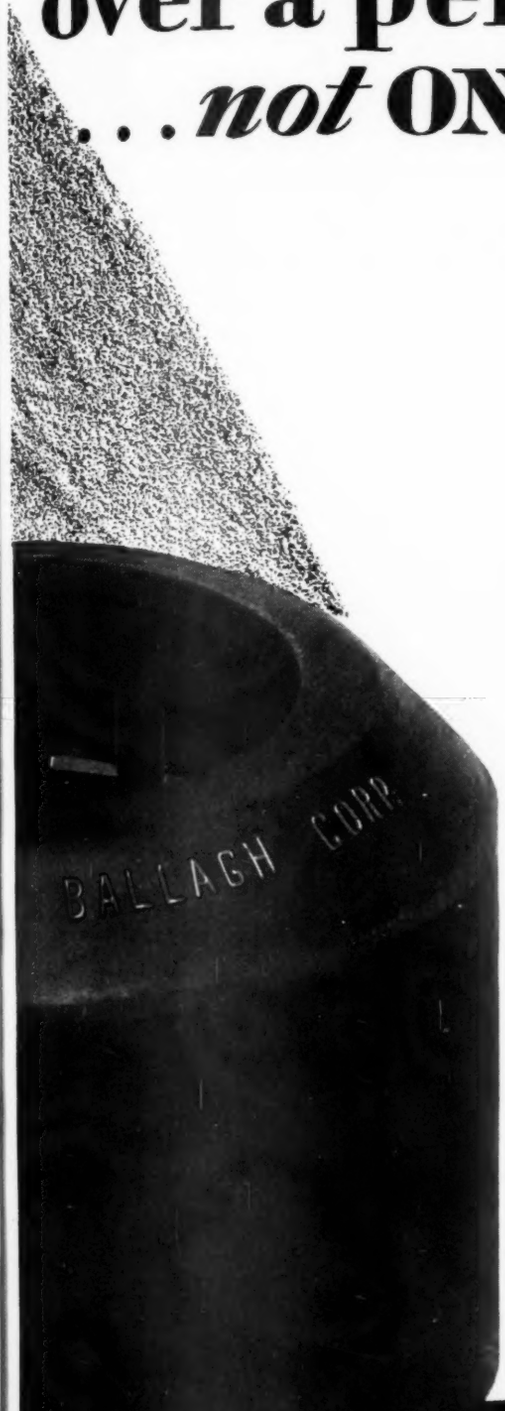


Fig. 7.

orders 6290 *Protectors* over a period of Two Years ...*not* ONE *lost in the hole*



A leading company operating exclusively in California has saved thousands of dollars in the use of Bettis Protectors and out of a total of 6290 Protectors ordered within two years reports 5000 still in service.

Many of their Bettis-protected strings have drilled 8 wells and are still in service. They've never had a fishing job caused by these Protectors. On the other hand they have prevented many twist-offs by reason of the reduction in friction and strain on the pipe.

This is a remarkable demand for one specialty product. But here is a record that far outstrips it. *Another operating company has ordered a total of 48,378 Bettis Protectors, giving us 442 repeat orders. No other product was ever given such strong endorsement.*

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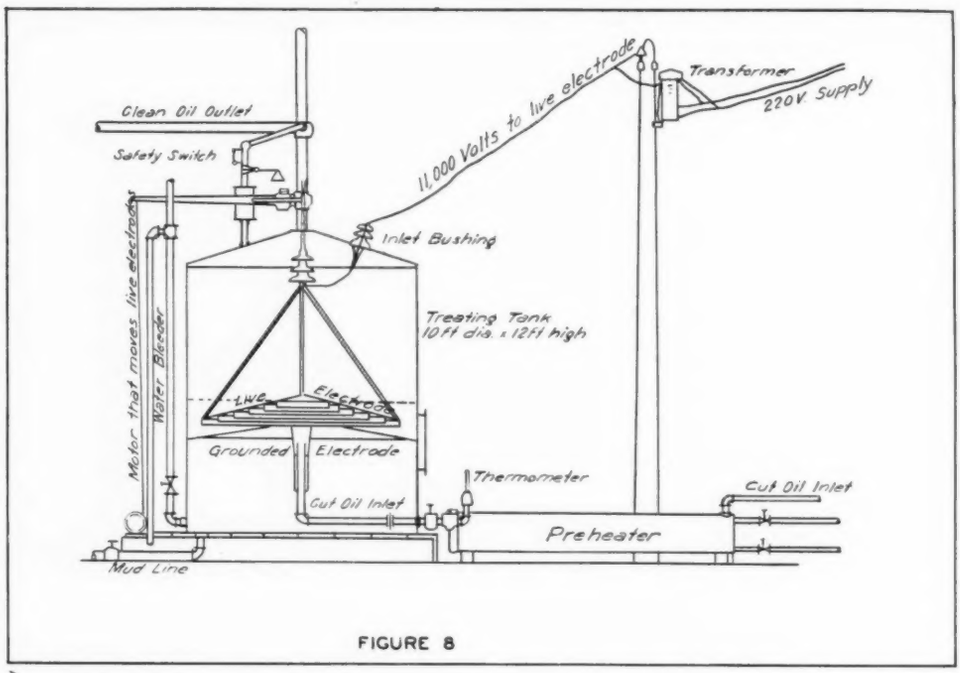
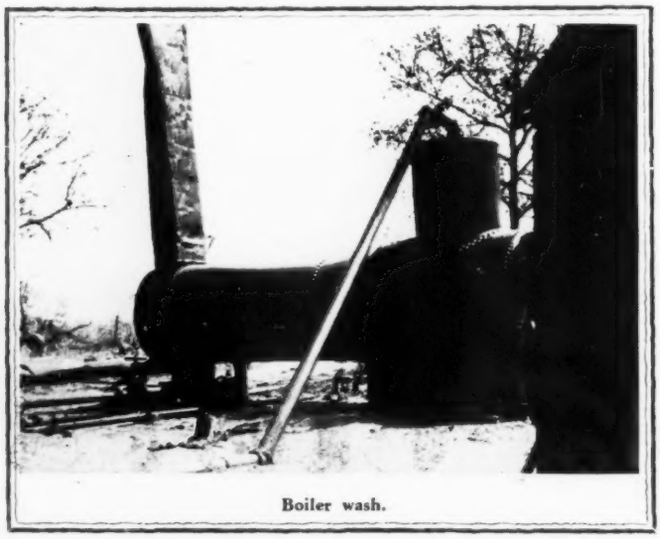


FIGURE 8

very satisfactory in most cases. Chemical is either pumped in or dumped down between the tubing and well casing twice a week, one-half gallon at a time mixed with twenty-five gallons of warm fresh water, depending on the condition of the oil and production of the well. Theoretically it is more correct to dump less chemical more often, but this proportion must be worked out. Since this method is in an experimental stage, figures have not been tabulated as yet. The known facts concerning treating down the hole are: (1) the oil is treated in as near a natural state as it can be found. (2) It is treated at as near a natural pressure as can be found. (3) No chemical is wasted. (4) It is treated under its natural temperature.

Electrical Dehydration.

In California and Gulf State oil fields, the majority of all emulsions are treated by electrical dehydration. In the Mid-Continent fields this method has not yet been perfected, though engineers are working on it religiously. The theory is as follows: "When brought within the field of influence of a high potential alternating current, the dispersed or scattered droplets of a petroleum emulsion coalesce, which readily settle out from the oil under the influence of gravity. In this process the emulsion is generally heated moderately to reduce viscosity and facilitates settling."



Boiler wash.

The above means, in less technical terms, that each minute globule of water is charged with electricity, causing it to bound back and forth striking others, rupturing the protective film about each, causing them to coalesce. Figure 8 shows cross-section of an electrical treater.

So far we have discussed what an emulsion is, types of emulsion and methods of treating them.

Why do we heat and chemically treat oil? Heat decreases the viscosity of oil with consequent decrease in frictional resistance to the settling down of drops of water. It tends to break the emulsion by weakening the film about each minute gobule of water through expansion, and allows them to coalesce and form larger drops which readily settle out. Chemical acts directly on the film around the gobule of water tending to rupture, dissolve, coagulate or soften it to the extent that through gravity and its own weight it ruptures the film surrounding it, coalesces and drops out.

Different chemicals react in numerous ways. One group tends to take up the water and form another substance. Another group reacts with the salts in the water. Another group tends to dissolve the material making up the protective film. And still another group tends to rupture the protective film.

The advantages of heat are heat treating is most rapid, large quantities of cut oil can be handled more rapidly with fewer stock tanks. The disadvantages of heat are the heavy loss of volume and lowering of gravity. The advantages of chemicals are no volumetric loss, no gravity loss, and less expense involved throughout.

For the last five or six years the price of oil per barrel has been determined by its gravity. Its gravity depends partly on its cleanliness and the manner in which it has been cleaned. If it becomes necessary to treat with heat, the gas tightness of equipment is the most important factor in preventing evaporation and gravity losses, and cannot be emphasized too much. If a little chemical is used along with heat, oil can be treated at a lower degree than without it, resulting in considerable saving.

New Problems Encountered in COLD-BENDING *Large Diameter Pipe*

THE comparatively recent trend toward building gas lines with larger diameter pipe has been attended by several changes and improvements in construction methods. Cold-bending large pipe is one of the more important of the newer developments. Because of the inability to apply heat uniformly, and due to the time consumed in making fire bends, cold bends are more frequently made. As pipe diameter increases this method of bending becomes a more difficult problem.

When lines were first constructed with 20-inch pipe it was considered doubtful whether a cold bend could be made satisfactorily with big pipe. After construction crews gained experience in cold-bending the larger pipe the method was followed extensively on virtually all bends, even to 90-degree bends in some instances. The same holds true, to some extent, with 22-inch pipe.

With the introduction of 24-inch pipe in Mid-Continent gas line construction, the pipe line contractor's cold-bending problem assumed a more serious aspect. Initial work with this size pipe indicates that a great many of the sags and over-bends will be made by cold-bending, while other types of bend will be made with fire in cases where the bends have not been made at the mill.

On the first section of its 20-inch gas line connecting the Oklahoma City field with the line running from the Texas Panhandle to Kansas City, the Cities Service Gas Co. is putting in ten miles of 24-inch pipe. Five miles of this is seamless pipe, the first 24-inch seamless pipe manufactured. It is 80,000-pound tensile strength steel with a wall thickness of five-sixteenths of an inch, 30-40 carbon pipe having 50,000-pound yield point and weighs approximately 80 pounds per foot. The pipe is built in random lengths and the ends are beveled to a 45-degree angle for welding.

Three miles of this pipe is solid gas welded and the other two miles have coupled joints. Around 80 minutes is required to make a weld. Five joints are roll welded alongside the trench and later tied in.

The other five miles of pipe in the section is 24-inch electric welded pipe with a tensile strength of 60,000 to 65,000 pounds, a 50,000-pound yield point, a quarter-inch wall thickness and weighs 65 pounds per foot. The pipe is a 20-30 carbon steel built with double bell ends and in 40-foot joints. Four miles of this pipe is electric welded and one mile is gas welded.

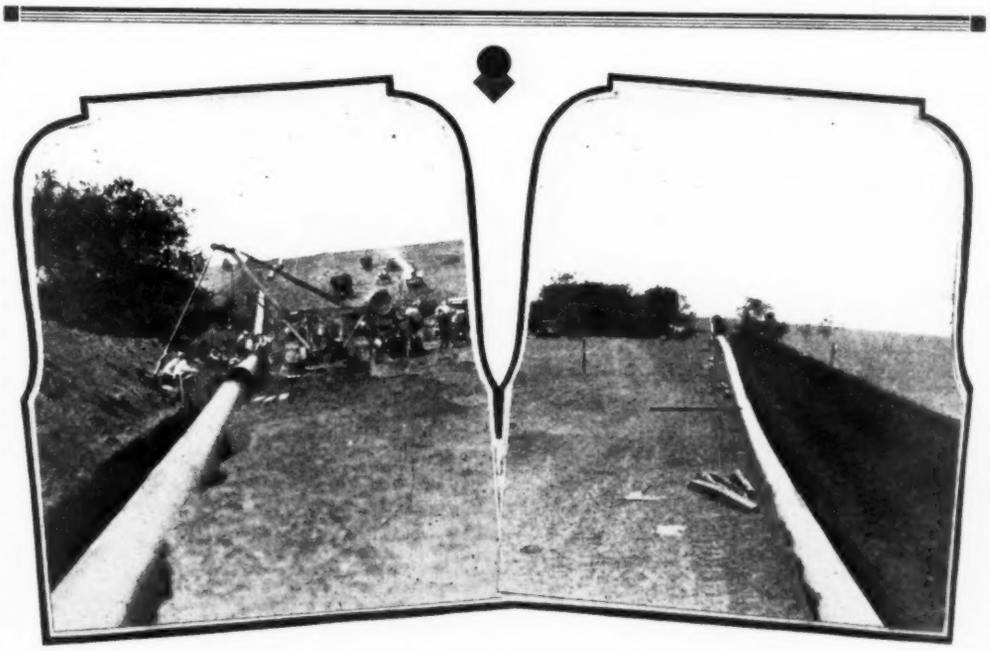
The last half of this 10-mile section traverses country that is badly cut by washes, most of which range from 5 to 15 feet in depth and 20 to 35 feet in width. Consequently, many bends are necessary.

During the early stages of construction it was decided to attempt cold-bending, although provision had been made to have some of the bending done at the mill. Some of the mill-bent pipe was put in the line where sharp bends were called for, but at this stage of construction three to five-degree bends are being made day in and day out without heat.

Kelly-Dempsey & Co., contractors who built the line, designed a bending iron to be used especially in working with large-diameter pipe. It is made of heavy iron and saddles over the pipe. The top part is flat and the saddle end fits snugly to the curve of the pipe. The iron is placed over the pipe at the center point of the bend and timbers are placed on top of the iron to distribute the weight of the tractor which is driven on top. Two other tractors, one located at each end of the section in the bend, pull up on the pipe to make the bend.

Best results have been obtained by having five joints, or approximately 200 feet of pipe, in the section where the bend is made. This affords a section of line with ample spring in the pipe with which to work.

All of the tractors on the construction job are heavy-duty machines. The one holding the pipe down in the center is made heavier by loading it with as much additional weight as possible in the form of paint drums, iron, etc. The two machines pulling up on the pipe use chain slings covered with heavy rubber hose to protect the pipe and, in a measure, distribute stress at that point.



Left—Construction scene on the 24-inch line near Oklahoma City. Right—A section of tied-in line, showing the slack wallops. The line is whitewashed to prevent coating from checking.

When everything is in readiness to start bending, the natural spring of the metal is taken up fairly rapidly by the two pulling tractors. From that point on until completion of the bend the

greatest of care is exercised. After taking up the spring the foreman in charge sees that the bend is made slowly in order to give the metal ample time to contract at one point and expand at another. This system helps the metal.

Ordinarily the pulling tractors raise the ends of the pipe at the rate of one inch per minute. This slow pull has been found satisfactory and gives the metal time to yield to the strain without buckling. As the experimental work progresses the relatively few instances of pipe buckling, in the opinion of men on the job, are due to too rapid pulling up on the ends of the pipe. Occasionally the tractor operators find it difficult to stay within the narrow limits allowed in pulling up on the pipe and give the pipe a sudden jerk. The most difficult cold-bending is on or close to a weld.

A carload of 24-inch pipe.

With the use of this method, three to five-degree bends are made from one position of the bending iron. Both the over-bends and sags are made in an identical manner, the pipe being reversed by tractors after the bend is completed when it is to be used for an over-bend. With the large-diameter pipe it is too difficult to hold down the ends and pull up at the center to make an over-bend.

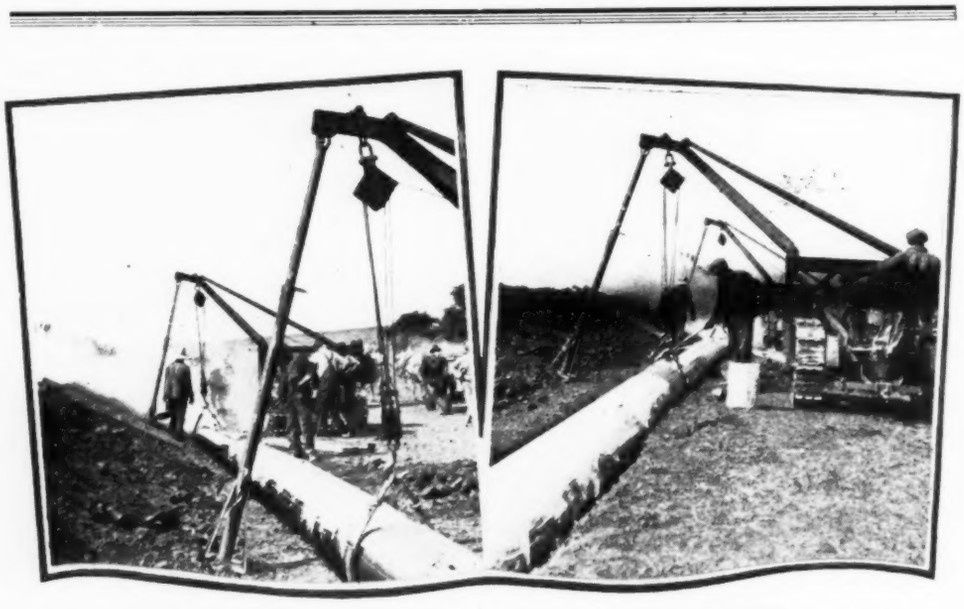
Those following the construction work believe it possible to make a 10-degree or even greater bend by this method. Part of the bend would be made with the iron in one position and the iron then moved to another position. By moving the iron in such manner, the desired degree of bend would be obtained.

Whenever the pipe buckles during the bending process it is cut out with a cutting torch. The damaged section is replaced with a new length of pipe and then the bend is made. The damaged section is sent to the field laboratory, where it is tested. An extensive study is being made of the welding on this section of the line. Samples are constantly being cut out and taken to the field laboratory, where the welds are broken, tested for pin holes, ductility and tensile strength. Records are made of each weld tested and these include the name of the welder, type of rod used, temperature of heat applied, condition under which the weld was made and a wealth of other information bearing on the weld.

Equipment in the laboratory consists of hydraulic pulling machines to test the strength of the welds, jacks used to test their ductility and motor-driven emery wheels to polish off the broken welds for closer examination. Each sample is stenciled so that it may be identified throughout the entire testing process.

Construction work is being accomplished with the most modern equipment. The ditchers are having little trouble cutting a trench 54 inches deep and 36 inches wide in the country, which is virtually free of rocks. Tractors are used in lining up the pipe and heavy clamps used to hold the pipe for the tack welds.

On the joints made by gas welding it requires around 80 minutes to make a roll weld. A back-up or chill ring is employed to make the joints on the double bell ended pipe which are electric welded. The ring is a quarter of an inch thick and two and a half inches wide. It fits snugly in the bell ends, facilitating lining up and expediting welding. Around 20 minutes is the average time required to make an electric weld made with two beads. Slack wallops are put in the line at intervals of every 500 feet, giving around 26 inches of slack per mile. Sections with slack wallops are put on skids over the trench during the day and are lowered the first thing the following morning.



Left—Applying hot application of enamel. Note tractors holding line in suspension to speed up painting. Right—Workman whitewashing behind painting gang.

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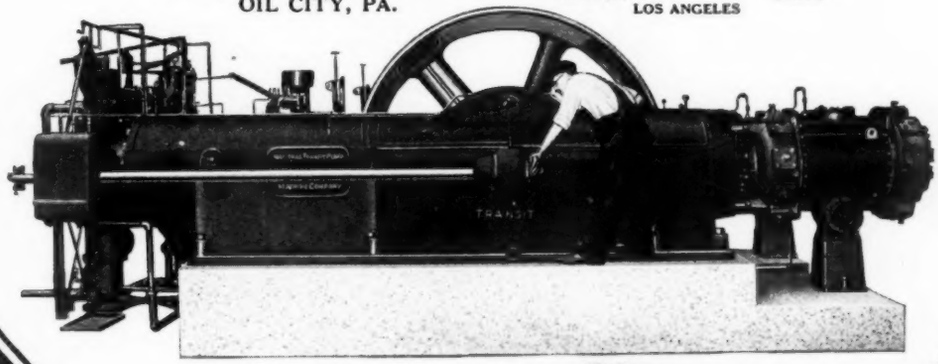

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» » *The How and Why of* Hard Facing *in the* Oil Fields

By MILES CATLIN SMITH[1]

SINCE 1922, oil field operators have been learning how to adapt hard facing to their operating requirements and the results are too well known to everyone connected with the petroleum industry to warrant repetition. Yet, during all of these eight years and even though hard facing is credited with almost unbelievable accomplishments, many operators have not, as yet, taken advantage of the possibilities of hard facing and few, if any, operators are utilizing hard facing to its fullest extent. For the oil field drilling operator, hard facing may be an attribute to greater operating economies than almost any other single process of procedure adaptable to oil field drilling practice.

Naturally, the application of hard facing on oil-field drilling tools comes in for consideration first. Hard facing was originally devised to resist the wearing away of drilling tools in service and all of the developments and employment for hard facing that have come later are, in reality, outgrowths of this first purpose. Welding up drilling tools, it will be remembered, was adopted as an improvement on the original method of forging the tools back to shape and the welding on of a hard facing or wear-resisting surface was accepted as an improvement on welding the tools back to shape with soft steel rod. The metallic diamond substitute and the so-called, super-hard alloys which have come into use during the past years can well be considered as an outgrowth of or an improvement on the first used hard facings.

With so many proprietary products on the market, each designed to fulfill oil-field drilling tool hard facing requirements, it is only natural that oil-field operators become more or less confused in their efforts to secure the product best suited to their individual requirements. Tests are sometimes misleading, or at least, not sufficiently convincing. However, there are several hard and fast rules governing both the selection and the application of hard facings which, if followed, should result in making the selection much easier. Naturally the primary requisites of any such a material are: they must be easy to apply or, at least, reasonably economical to apply; they must resist wear while the tool penetrates through the formations found in each drilled hole, and most important of all, they must stay on.

Drilling tools are hard faced for two primary reasons: to facilitate the drilling tool's penetration through hard formations and to keep the drilling tool to size and gauge as it penetrates. Penetration is the primary requisite, to be sure, yet, if the tool does not hold to gauge, the tool will get into as much or more trouble than it would with less ability to penetrate. This fact should be kept constantly in mind when hard facing is considered or applied and, what is more, this applies to all types of bits, coring bits as well as simply penetrating bits.

Top—Fish-tail bits that have been hard faced have given some most surprising performances in the hardest of formations. Bottom — Illustrating the application of hard facing on standard cable tool reamers. The reamer in the foreground is unfaced and the one in the background has its reaming edge protected with a layer of metallic diamond substitute and hard facing overlay.

Since each

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one of the various marketed proprietary products that come under the category of hard facing materials is recommended to be applied under a specific and individual application method, it is quite impossible to take any one or more of these methods and point them out as best. Likewise, inasmuch as there are several different opinions among the oil-field operators relative to the most effective shape of a drilling bit, there can be no hard and fast rule for building a bit to any particular shape. With it all, though, there is one undeniable requisite of oil-field drilling bit hard facing and that requisite is: the bit must be protected where the wear will be greatest. This is true, irrespective of the hard facing material or materials used.

Perhaps, it would seem to be considering the subject backward to begin with the latest of the types of hard facings and take up their applications and methods of use first, but in this day and age of oil field hard facing utilization, the use of the, so-called, metallic diamond substitute appears to be the one all-important subject for discussion. The majority, if not all, of these metallic diamond substitutes marketed today consist chiefly of some one or more of the tungsten carbides. Tungsten carbides have quite unique and distinctive physical and chemical characteristics and have been found to be most adaptable to oil field drilling requirements. On the other hand, tungsten carbides, regardless of whether they be in the quite pure form, or in the cemented form, possess other physical and chemical characteristics not so desirable and which must be taken into consideration if their application be in every way successful.

Reading top to bottom—Tongs that have been hard faced; putting on a hard facing with the oxy-acetylene torch; arching on an overlay of hard facing.

Tungsten carbides are brittle. They are relatively hard, well up in the scale of hardness to the hardness of the diamond, but, like the diamond, they attain this hardness at the sacrifice of inherent strength and are brittle. With this in mind, tungsten carbide metallic diamond substitutes should be so employed that they are well supported and, in a measure, protected. When employed for industrial purposes the diamond is always so set that it will be well supported and protected and the same holds true with the metallic diamond substitute. Both will readily cut less hard formations and when used on oil-field drilling tools they will greatly increase the penetration powers of the drilling tools, but, when they are used, only a small portion of the outer surface of the diamond or the substitute should be exposed at a time.

As is well known, the diamond must be supported in a specially prepared setting. The metallic diamond substitute, on the other hand, is much easier to apply, in that it may be imbedded in a setting that has been formed by welding on metal. Under the heat of either the electric welding arc or the acetylene torch, the tungsten carbide metallic diamond substitutes do not melt down unless the heat is well confined and is applied over a period of time; consequently, it is possible to weld metal around, even over the top of, the metallic diamond substitute and in no material way affect it. As a matter of fact, that is the identical method of application most often recommended and used. The metallic diamond substitute pieces are placed either in a recess that has been machined out or made with a cutting torch, or the pieces are simply placed on the surface to be covered and then a layer of metal, preferably a wear-resisting metal, is welded around, between and over them. If a wear-resisting deposit forms the setting for these metallic diamond substitutes there is less opportunity for them to be unduly exposed and, owing to their brittleness, fracture off.

Metallic diamond substitutes of the tungsten carbide variety that have been welded to oil-field tools by depositing a layer of wear-resisting metal about them and over them form a quite unique overlay for the drilling tools. The surfaces so protected have the penetration possibilities of near-diamond hardness, yet, due to the slow wearing away of the matrix of wear-resisting deposit about them, there is little or no opportunity for the metallic diamond substitute pieces to fracture away through long periods of service. A most convincing example of the resistance to wear of such surface is found when drilling bits are so overlaid at intervals and, in consequence, are permitted to finger. That is, the protected parts do not wear and the unprotected parts do wear with a resultant formation of prongs or fingers on the cutting edge of the bit.

Although the metallic diamond substitutes have been almost universally recognized as essential to the maximum in oil field drilling economy, there are still those operators

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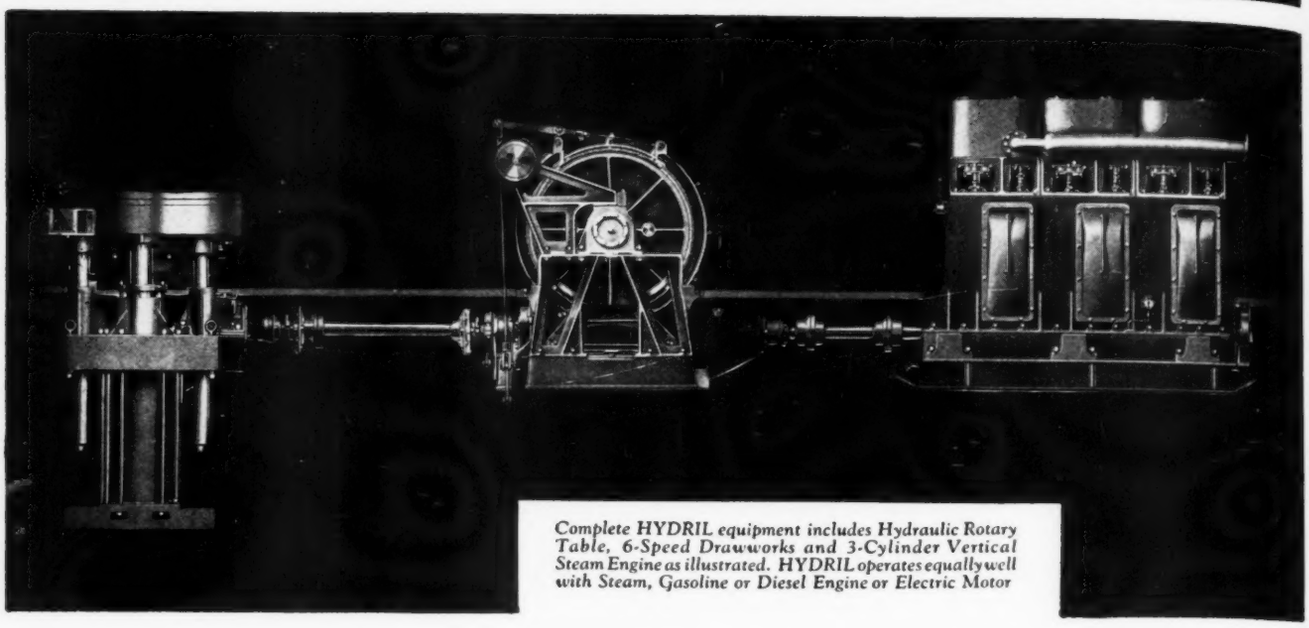

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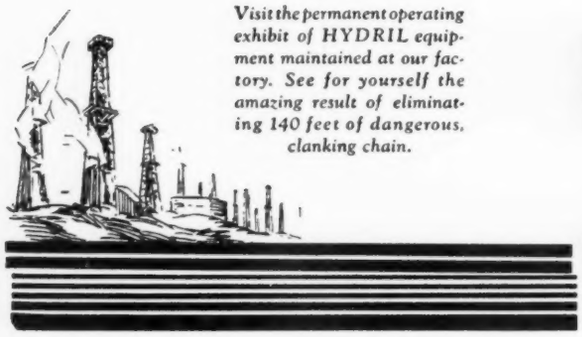

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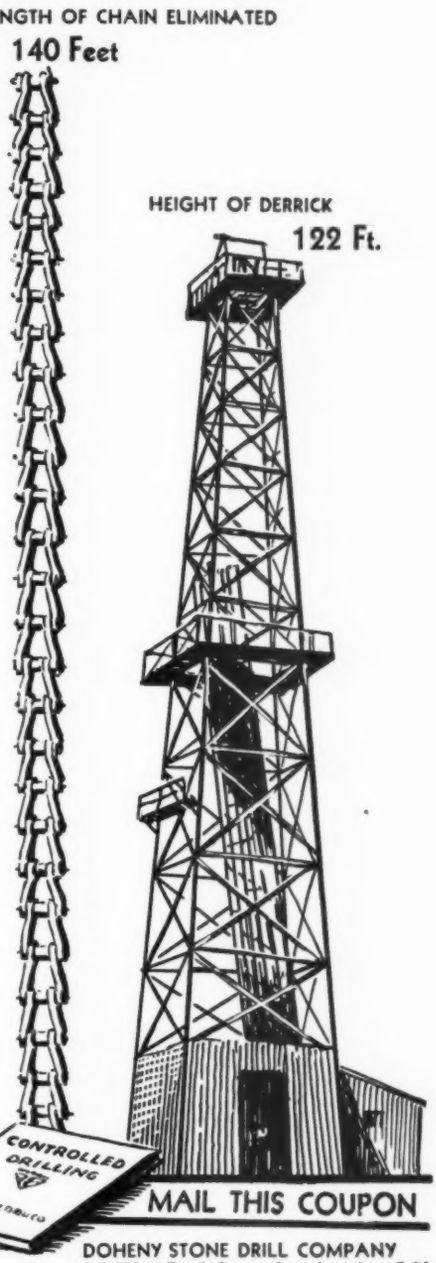

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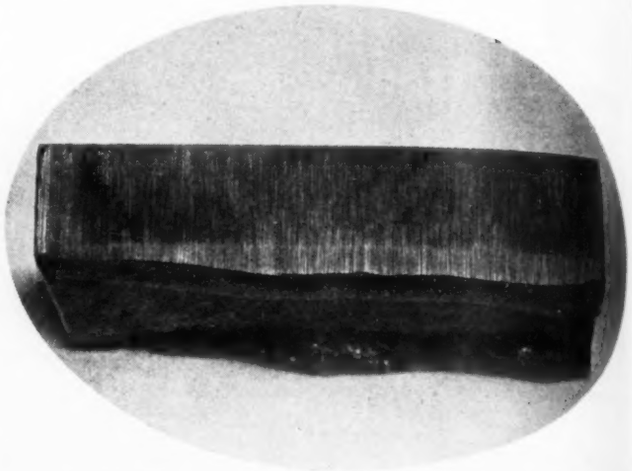
who feel that the use of metallic diamond substitutes is not essential in all instances and bits that have been overlaid on their wearing surfaces with a less wear-resistant deposit will fulfill the majority of requirements sufficiently well. Such overlay deposits are applied with either the electric welding arc or the acetylene torch and the procedure consists in the melting down of an alloy welding rod and so forming the deposited beads that they cover the desired area. Even such deposits oftentimes are relatively brittle and, in their use, care should be taken not to build up large unsupported deposits. When it is found necessary to build up a section, the building up should be done with a carbon-steel rod, preferably one with a high carbon content, and then the built-up section may be protected by covering it over with the wear-resistant deposit.

On the whole, hard facing of oil-field drilling tools consists of covering an area of the tools, necessarily those areas which are subjected to the most wear, with a layer of welding beads. This deposit formed by the welding beads may be of whatever consistency the service demands, but oftentimes it is much more desirable to give up something in hardness in order to eliminate damaging brittleness. Prior to the advent of hard facing, the drilling tools wore away and were reforged back to shape. Hard facing of any sort is considerable of an economy over that. Where the formation is unusually hard or the well is of considerable depth, the use of metallic diamond substitutes is quite obligatory. At other times the use of metallic diamond substitutes will result in greater economies, but any hard facing may be found enough of an improvement over the unprotected bits to be worthy of use without the metallic diamond substitutes.

Generally speaking, the hard facing of oil field drilling tools is well recognized as an attribute to drilling economy, yet little consideration has been given generally to the many and sundry other applications of hard facing which exist in oil field drilling operations. Aside from the drilling tools themselves, there is no end of equipment used in oil field drilling operations that is subjected to severe wear and abuse. Any and all of such equipment is open to consideration as a hard-facing prospect.

Hard facing is the deposit from an alloy steel welding rod which, after it has been melted down in the autogenous fusion welding process, cools to a hard abrasive-resistant mass. It is of such a consistency that it would be impossible to construct or cast machine parts in their entirety of the metal, yet when deposited to form a surface it gives that surface the qualities necessary to resist wear and that wear may result from the abrasion of contact with the earth's formations or contact with other metals. Properly applied, hard facing is a veneer of not more than a half inch in thickness that is well amalgamated with, in fact has actually become a part of, the metal surface veneered.

A very good demonstration of fingering—wearing away between the hard facings.

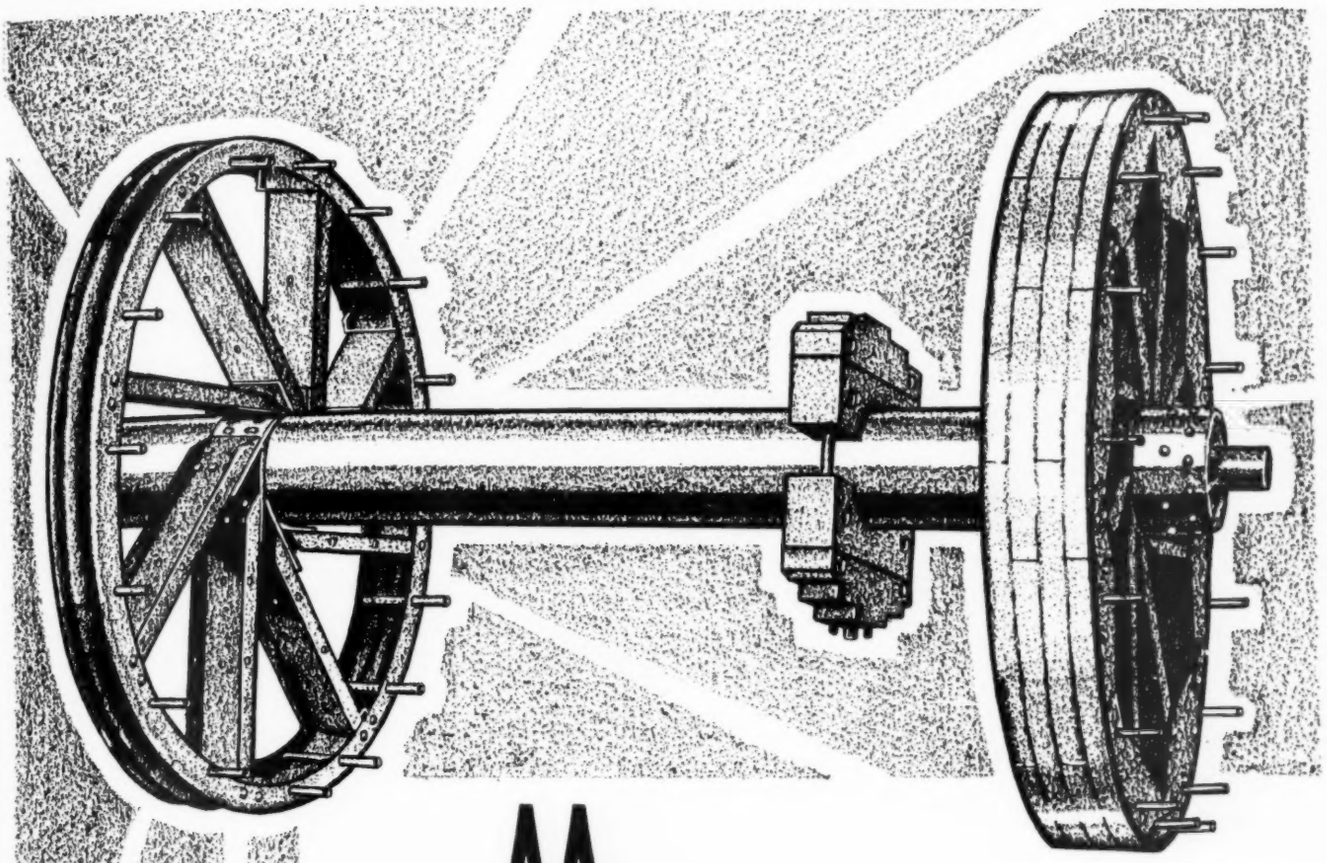


A cross-section through an overlaid part showing the easily distinguishable line of amalgamation between the overlay and the parent metal.

It would be both a difficult and an almost endless task to list the various and sundry applications of hard facing which may be found in oil field drilling operations. Other industries have found that hard facing has made possible quite unbelievable economies and the same could be true of a more general adoption of hard facing to oil field drilling. Hard facings, practically all of them, are too hard to be machinable, yet they may all be ground to a smooth surface where and when desired, so their use is not prohibited on parts that are ordinarily machined. After being ground to smoothness, hard-faced surfaces have many desirable qualities aside from the fact that they are wear-resistant and, quite naturally, hard. Such surfaces have proven to be far superior in many ways to surfaces that have been treated by some method of heat treatment in an effort to prepare them against wear. Hard facings, as a process, has the one great advantage over any other method of surface preparation. It may be applied where, and only where, desired without bringing about any physical or chemical change of the metal to which it is applied.

Machine and machinery manufacturers everywhere are beginning to realize the possibilities of the adoption of hard facing. By hard facing to protect the parts subjected to the greatest wear, it is possible to design and construct for strength, alone, and weld on the surface required to meet and combat the abrasion to which it will be subjected. Such a move will not only result in construction economies, but will, as well, facilitate maintenance. Hard-faced parts may be hard-faced again and again without the necessity of any part renewals; in many instances, without even removing the part from the entire assembly. Oil well drilling equipment is subjected to particularly hard service and such a method of fabrication would, without doubt, result in material savings to both the machinery builder and the user who must stand the maintenance expense.

Simply to say that hard facing is adaptable wherever there is wear is a broad statement, quite true, but broad. Perhaps, with a full understanding of just how hard facings are composed and a better knowledge of their prop-



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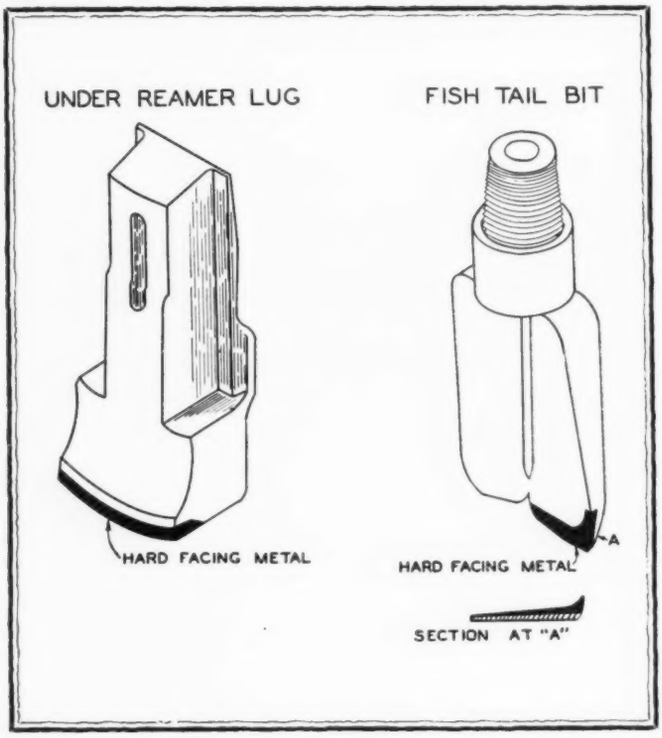

erties, it would be much easier to recognize their proper applications.

Almost without exception the present known and used hard facings have been determined with a view to securing an alloy that would, after being melted and allowed to cool in the open air, form a relatively hard deposit. The thought was that hard substances will resist wear much better than soft substances, so wear-resisting overlays should, above all, be hard. In fact, it was this line of reasoning which was responsible for the now generally recognized term, "Hard Facing."

In many ways this line of reasoning was logical, but excessive hardness is ever accompanied by brittleness. At least present-day metallurgy has been unable to divorce hardness from brittleness. Consequently, only very recently the manufacturers, at least a few of them, have realized that the brittleness of excessively hard substances was a greater handicap than the accompanying hardness was a benefit and have changed their lines of reasoning and research. In fact, at the present time the goal to be reached by the manufacturers of overlay or hard facing materials is to acquire wear resistance with only moderate hardness. Such a product should have inherent strength and little, if any, brittleness.

Oftentimes it is quite desirable to sacrifice something in the way of maximum wear-resistance in order to eliminate damaging brittleness. In other words, it would be far better to renew the protection oftener than to have the protection prove unsatisfactory on account of its brittleness. At this day and time it is possible to secure alloy welding rods and materials which will give almost any desired deposit. Some are soft, some are hard, some are this and some are that; so in the selection the prospective user should analyze the conditions present and make his selection best to fulfill those conditions. The maximum in economies will only result from the maximum in efficiency, which includes first cost, cost of application and cost of renewal as well as length of useful life.

One might dwell at length on the metallurgy of so-called hard facings, but the information would be of little benefit to the users of hard facings. Aside from the quite pure tungsten carbides that are, for the most part, used as metallic diamond substitutes, hard facing materials are all quite complex alloys. Some of them are compounded around an iron base so that they will readily amalgamate with the metal to which they are applied. Some of them are compounded with little, if any, iron and must be applied so that they will not be diluted through puddling with the metal to which they are applied. Some are more adaptable to electric application than to acetylene application, and *vice-versa*. However, all of them have their individual merits and limits which must be taken into consideration when making a selection. Just what an alloy contains is far less important in choosing the proper alloy than just how well the deposit from the alloy will stay in place and endure in the service to which it is subjected. The one and only method of infallible selection is to secure the alloy that is apparently best and then put it through the test and prove that it is best as well as most economical, taking every phase of the application into consideration.

Hard facing, after eight years of use, is still in its infancy as a process and great strides in the progress of development may be expected. The process has proven its usefulness and the next imperative step in its development is broader adoption with consequent broader experience through which the manufacturers may still perfect their products. It was in the oil field drilling industry that the process received its first reception and the oil field drilling industry should continue as a proving ground until the ultimate in the production of a wear-resistant surface is acquired.

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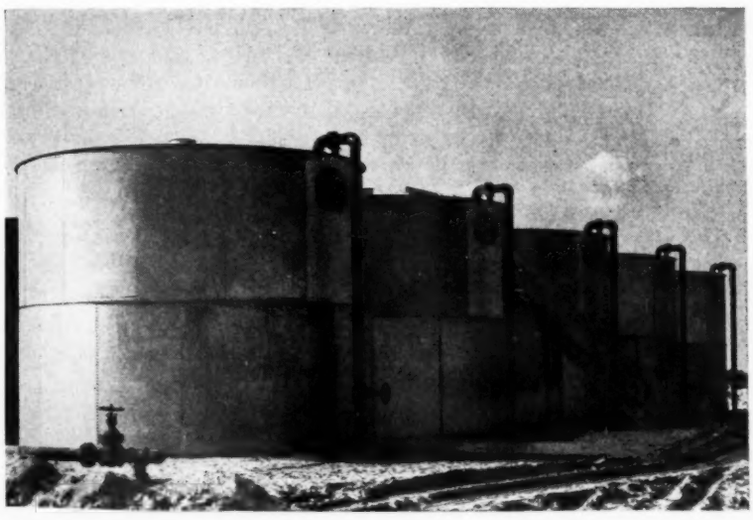

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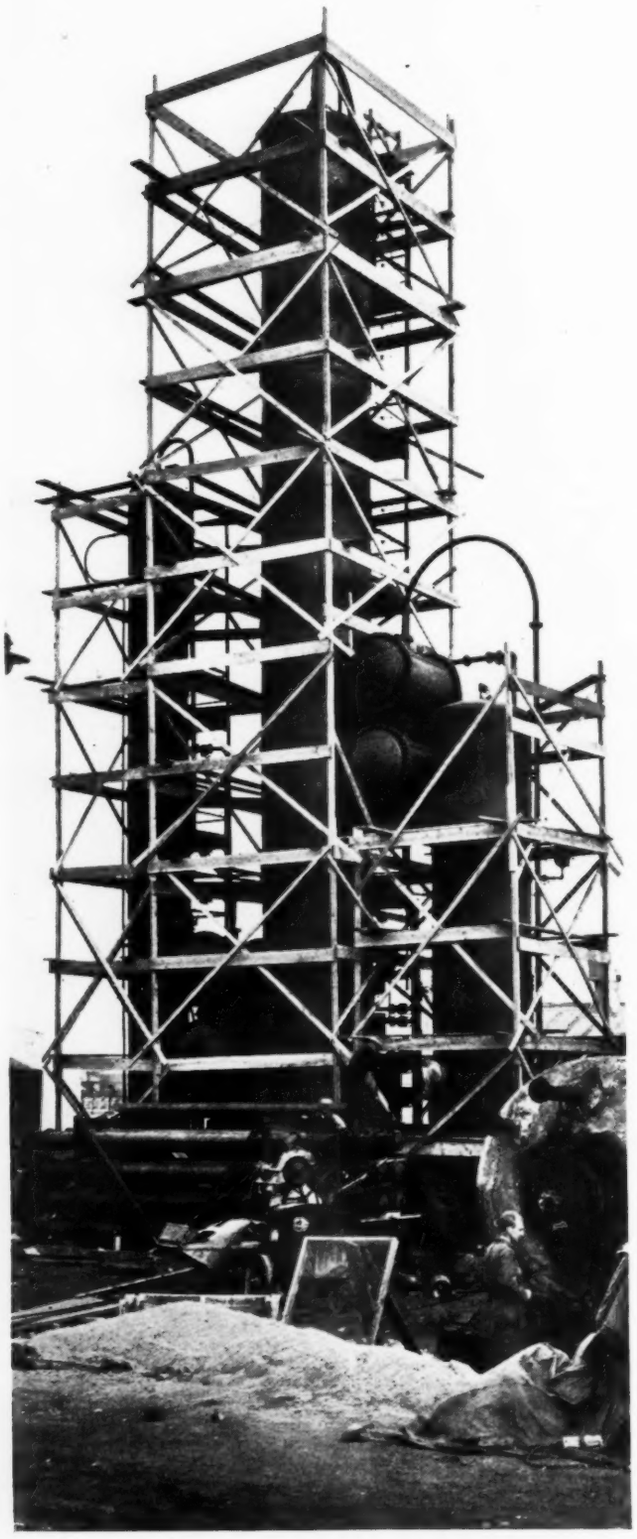
The Use of Litharge in

Sweetening Gasoline *and* Kerosene

By R. L. HALLETT* *and* W. H. SOWERS*



Pressure distillate stabilizer at a Continental Oil Co. refinery.

GASOLINE and kerosene as produced from most crudes by fractional distillation contain sulphur compounds which must be removed by refining operations before these petroleum products are suitable for use. If the sulphur compounds are not removed, these products will give a disagreeable odor of sulphur dioxide when they are burned and will cause incrustation of the burner, wick or engine cylinder.

Sulphur is present in unrefined gasoline and kerosene in a number of forms, but for practical purposes may be considered as being dissolved in the petroleum products mainly in the form of hydrogen sulphide (H_2S) and one or more of the mercaptans which are paraffin hydrosulphides or sulphur alcohols—that is, alcohols in which the oxygen has been replaced by sulphur. The type formula for the mercaptans is RSH, in which R represents the radical of the paraffin series. Nearly all unrefined gasoline and kerosene contain mercaptans and generally contain some hydrogen sulphide.

The hydrogen sulphide is easily removed by giving the petroleum products a simple treatment with a water solution of caustic soda and the mercaptans are removed by treating with sodium plumbite solution (the so-called "doctor" solution) and sulphur.

Sodium plumbite solution is made by dissolving powdered litharge in a water solution of caustic soda whereby the litharge (PbO) combines with the caustic soda (NaOH) to form sodium plumbite (Na_2PbO_2) and water.

When gasoline or kerosene is agitated with doctor solution carrying finely divided sulphur (flowers of sulphur) in suspension the mercaptans react with the sodium plumbite and sulphur with decomposition of the original sulphur compounds and the formation of insoluble lead sulphide. This treatment will break up and remove the complex sulphur compounds far more completely and satisfactorily than any other process which has been proposed.

The Sweetening Process

Unrefined gasoline and kerosene, in addition to sulphur compounds contain certain tar substances which give the petroleum products a yellow color and cause them to burn with a smoky flame. These tar substances must be removed, as well as the sulphur compounds, for the gasoline and kerosene when marketed must be clear-burning and colorless.

The complete refining process consists in treating the crude distillates with sulphuric acid to remove the tar substances, then with caustic soda solution to neutralize the remaining acid and remove the hydrogen sulphide, then with sodium plumbite doctor solution and sulphur to remove the other sulphur compounds and finally washing with water. Some crude distillates do not require all stages of treatment, but gasoline and kerosene from most crude oils should be given the full treatment.

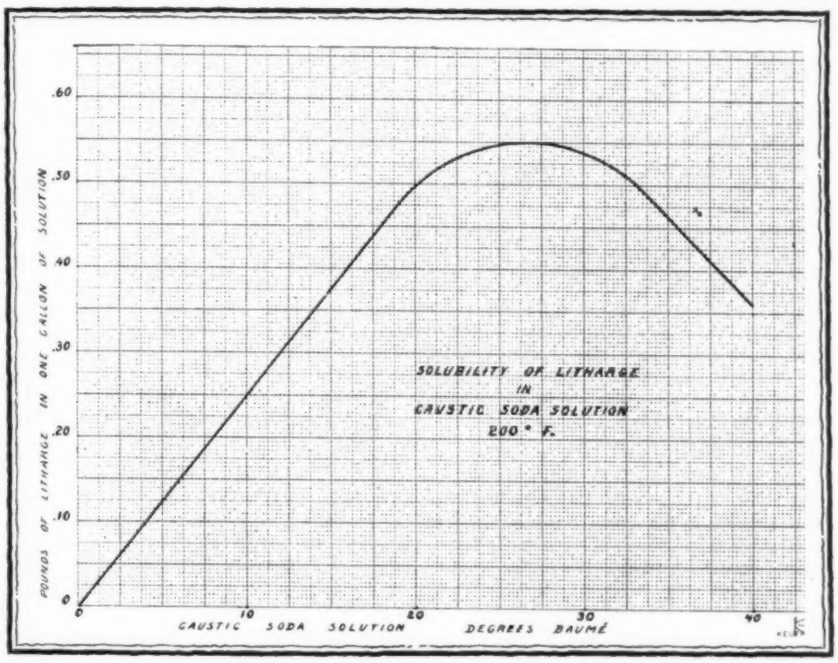
The refining is conducted as either a batch or continuous process. Kerosene is usually refined by the batch process, in which there is greater danger of evaporation

* National Lead Company, New York.

loss, and the more readily volatile gasoline is generally refined by the continuous process, which minimizes loss by evaporation.

Batch Process

This process is mostly used for kerosene and the heavier illuminating oils. The refining is done in high cylindrical lead-lined steel tanks having a cone-shaped bottom and covered with a hemispherical steel dome. The tanks usually hold 4,000 to 5,000 barrels and are lined with sheet lead. Each tank is fitted with a pump and connecting pipes which draw the mixture of kerosene and refining solution from a point near the top of the tank, pump it through a mixing device and then force it back into the tank at the bottom of the cone. This produces a continuous efficient circulation and mixing of the contents of the tank. By a suitable valve arrangement the pump and pipe line may be used to fill the tank by drawing the kerosene from the storage supply and pumping through the mixing device into the tank. When the tank is filled the valves are reversed and the circulation and mixing of the batch in the tank is started. Each tank also is fitted with a system of pipes at the top above the charge, through which water for washing may be sprayed onto the top of the kerosene. A discharge pipe at the bottom of the cone is used to draw off the settled acid, refining solution and wash water after the respective operations are completed. There is a separate discharge pipe for drawing off the refined kerosene after the treatment is finished.



After the tank is filled with unrefined kerosene the proper amount of 66° Bé sulphuric acid is run in and the kerosene and acid are circulated through the mixer until the tar substances have been taken up by the acid and the kerosene has become colorless. The acid is then allowed to settle and is drawn off. The kerosene then receives successive treatments with caustic soda solution, doctor solution and wash water. Each solution in turn is circulated with the kerosene through the mixer and is then drawn off before the next treatment is given.

Continuous Process

Almost all of the gasoline is treated by this process. The apparatus consists of a number of verticle cylindrical lead-lined steel tanks, each about 15 feet high and 6 feet in diameter, connected in series by means of suitable pipes and pumps and with mixing devices in the line between the tanks where mixing is required. The successive tanks or groups of tanks are partly filled with sulphuric acid, caustic soda solution, doctor solution and wash water.

The gasoline is forced through the series of tanks by the pumps which draw it from the top of each tank and pump it into the bottom of the next tank in the series. The gasoline comes to the top of the acid or solution, so that only the gasoline is drawn from each tank and is pumped into the next one, the acid, solution and wash water remaining in their respective tanks until they become so spent or foul that replacement is necessary.

Preparation of Sodium Plumbite Solution

The sodium plumbite solution is usually prepared in a cylindrical steel tank. The tank has a perforated iron pipe running along the bottom through which compressed air is forced to give efficient agitation of the solution. The tank also contains a closed iron steam coil for heating.

New sodium plumbite solution is made by first filling the tank with 20° Bé caustic soda solution and then adding oil refiner's litharge, during which operation the solution is heated by steam to nearly 200° F. and is continuously agitated by air. Litharge is added until the solution is saturated and some excess litharge is always used. After the batch is finished the agitation is stopped and the excess litharge is allowed to settle to the bottom. The clear supernatant sodium plumbite solution is then ready for use and is drawn off and pumped to the storage tanks. The excess litharge remaining in the preparation tank is used in making the next batch of solution. The finished solution is always alkaline.

After the sodium plumbite solution has been used for refining gasoline or kerosene and has been removed from the treatment tanks it contains impurities consisting mostly of insoluble lead sulphide sludge and is deficient in lead and caustic soda, which of course are consumed in the refining operation. The sludge is removed by settling and the clear used solution is then brought up to standard strength by the addition of the necessary caustic soda and litharge, after which the renewed solution is ready to be used again. In this way the old sodium plumbite solution may be used over and over again with the addition of caustic soda and litharge after each treatment, although of course some new sodium plumbite solution must be added from time to time to make up for the losses.

The solubility of litharge in caustic soda solution increases with the increase in strength of caustic soda up to a maximum which is reached with caustic soda solution of about 25° Bé, after which the solubility of litharge decreases, as shown in the accompanying chart. For this reason the caustic soda solution used for making sodium plumbite should be carefully prepared and 20° Bé is the strength usually considered desirable.

The litharge used for making sodium plumbite should be finely ground so it will dissolve rapidly and completely in the caustic soda solution. The litharge should not be so excessively fine that it will ball up when added to the caustic soda solution. Generally speaking, a furnace-made litharge which has been carefully ground in mechanical mills is best for this purpose.

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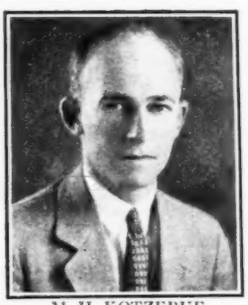
L. K. BALDWIN
Junior Engineer
Washington U.



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TANKS REFINING EQUIPMENT

Reducing *the* Down Time *of* PUMPING WELLS

By F. W. SHELTON[1]

THE question arises whether any oil is actually lost in the formation due to many pulling jobs of rods and tubing, but we do know there is a large economic loss due to labor charges, repairs and replacements, and the lengthened production period necessary to obtain the ultimate recovery. There is actual waste of oil on the surface of the ground due to the draining of the oil from the pulled tubing, usually caught by the slush pit but not reclaimed. There is probably a formation loss due to loss of energy of the escaping formation gas.

There are some simple rules gained through pumping experience, and tests made by equipment manufacturers, that all lease men can follow. The problem is to make these rules a part of the daily habits of the lease men, either a hard or an easy problem depending on the attitude of the supervisors. There are few lease men who, if taken into the confidence of the engineering departments, will not co-operate fully in the "practical technical" work on the lease. Any lease man working on a certain job, but in the dark as to the objective of the work, makes a poor workman and does a poor job. Most men take some pride in their work, as competitive jealousies and "crabbing" about this and that phase of it show some degree of interest. Psychology, as it is called in the office, or human nature, as it is known on the lease, is one and the same in getting results through co-operative effort among the personnel.

[1] Consulting Petroleum Engineer.

Figures mean little to most men while visual forms mean a lot. A picture attracts attention when the printed word fails. Instead of keeping the production and cost curves in a desk, put them on bulletin boards in places where the lease men can see them—such as warehouses, shops, lease production offices, boiler houses, etc., with sufficient explanation that they may be interpreted by all. Records should be kept up to date and posted in lease offices in simple forms, where they can be seen by all gang pushers and lease foremen.

Accounting methods make the lease the unit, but the individual well, gauged and tested each week, should be the unit for the production department. More profit is lost by not knowing the exact rate of production of the single well, than from any other cause except fishing jobs. The work of keeping up this daily production and down time curve or graph picture falls on the lease clerk, production foreman, or anyone in the lease office, and requires only a very small part of his time.

Care in Handling Rods

Manufacturers' rod specifications cover present working conditions, but not present abuses. With derricks over wells, rod hangers pay for themselves in three pulling jobs, taking into consideration saving in labor cost of pulling time, loss of production, and much loss caused by sharply bending rods when laying them horizontally. This causes weakness that means another pulling and fishing job in a short

TIME PULLING____ HRS.____ MIN.
TIME PULLING____ HRS.____ MIN.
TOTAL TIME ON JOB
HRS.____ MIN.____

GAS-STEAM ENGINE OR TRACTOR____

DAILY REPORT OF WELL PULLING

DATE____ WELL NO.____ LEASE____

PULLED				PUT IN		
NUMBER OF FEET	NUMBER JOINTS	MAKE AND CONDITION	EQUIPMENT	NUMBER OF FEET	NUMBER JOINTS	MAKE AND CONTROL
			Anchor			
			Perforations or Gas Trap			
			Gas Anchor			
			Working Barrel			
			Tubing (From Working Barrel To Tubing Catcher)			
			Tubing Catcher			
			Tubing (From Tubing Catcher To Surface)			
			Rods			
			Rod Subs			
			Trav. Valve or Plunger			
			Standing Valve			
No.	Kind		Cups	No.	Kind	
No.	Kind			No.	Kind	

REASON FOR PULLING____

Report here amount of paraffine removed; any work not shown above or any peculiar condition of well.

CREW____

GANG PUSHER____ FOREMAN____

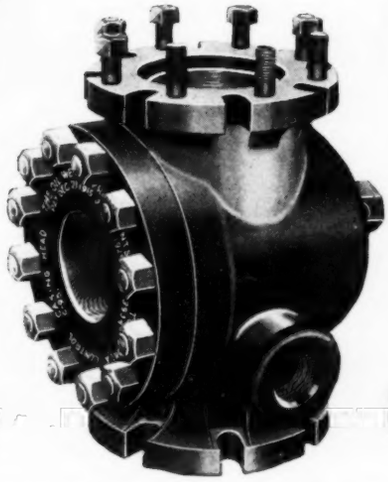
Embodying ALL FEATURES of All other Types of O. W. I. Control Heads Now on the Market

The All-Purpose CONTROL HEAD Equipment

"All-Purpose" Control Casing Head with "Set Screw" Top Flange for oil saver and "Lubricating Flange" which is bolted above Set Screw Flange and permits use of Control Head for running tools under heavy flow or gas pressure.

(Below) "All-Purpose" Control Casing Head with "Set Screw" Top Flange for Oil Saver and bottom flange for changing thread or casing size.

(Above) "All-Purpose" Control Casing Head with "Latch Assembly" Top Flange and without bottom flange for changing thread or casing size.



(Right) "All-Purpose" Control Casing Head without Top Flange for Oil Saver and without bottom flange for changing thread or casing size.

THE "ALL-PURPOSE" CONTROL HEAD is being used in Turner Valley, Alberta, and embodies every feature of the Type "X" Control Head which is standard equipment at Oklahoma City, Lovell, Big Lake, Yates Pool and other places. It enables the operator to have any type, size, or thread in control head construction from 9" down, by having only one control head body and one oil saver, and by merely having the desired top and bottom flanges for changing the heads.

"All-Purpose" Heads, up to and including 9" O. D. are regularly oil-tested to 3,000 lbs. pressure. Double bypass outlets provide anchor lugs for securing head. Bottom of heads threaded to casing size and thread desired. Extra bottom flanges available for changing casing size or thread. Fittings for bypassing pressure to lubricating chamber as shown in above illustration not furnished by us. Use standard lease fittings.

Write for your copy O. W. I. Co. Temporary Catalog featuring All-Purpose and Type "X" Control Heads and Oil Savers.

THE OIL WELL IMPROVEMENTS CO.
Tulsa, Okla.

time. A permanent wire line sling over the water table on each derrick, supports the portable rod hanger carried from well to well. A direct cause of some rod breaks has been traced through markers to the rod gang hitting a bent place in the rod with a rod wrench while the weight or tension is on the rod. Straighten the rods on the ground, using a block of wood as a buffer covering the rod while using the sledge hammer. If a bent rod is discovered on deep wells, replace with a straight rod. It will save another pulling job.

Line up the bridle or beam rod hanger to save extra wear on the packing in the stuffing box. There is more waste and fire hazard through leaky stuffing boxes than almost any other small detail about the rig. Another cause of leaking stuffing boxes and well connections is poor alignment of beam and polish rod caused by the beam not being balanced in its arc of travel. When the rig is built, either the Sampson post is too high or low, or the pitman too long or short (depending upon your view), causing all the motion to be from the horizontal downward or horizontal upward.

Thirty-foot rods have many qualifications in their favor, among them being: Less time for pulling and running; less weight per foot of rod; more elasticity to absorb shocks and jars; less pins and boxes to break; less restriction of oil travel due to fewer boxes, resulting in: (1) less friction loss; (2) less emulsion of oil; (3) less loss in gravity.

Small Savings in Power Costs

These are all small benefits, but the fact cannot be overlooked that an accumulation of small savings make for savings in production costs and greater profits.

In districts with scattered leases where derricks are over wells, a mobile rod tubing outfit was designed as follows:

The lease truck with winch was rigged up with a sprocket on the end of the winch shaft, to be connected by a drive chain to a sprocket on the shaft of the bull or pony bull wheels. The truck is backed up to the derrick, the chain thrown over the sprockets, a jack used from the derrick foot sills to the back of the truck to tighten the chain and brace the truck, and then everything is ready to pull. This kind of a rig-up with a truck may be used to good advantage in some cases, allowing the lease truck and winch to make full-time earnings.

Abuses in Handling Tubing

Throwing tubing off the truck on the rack or ground flattens and puts the tubing out of round in spots. These spots are worn much more quickly by rod travel, which is the cause of much split tubing.

On pulling tubing the crews will sometimes pound the collars (if hard to break out), with any tool handy from a wrench to a sledge hammer, hitting the collars any place from the center to the bell. This abuse has resulted in parted tubing due to injury to the threads, has caused leaks which at lower depths mean a big loss, as a small leak under pressure is equal to a big leak on the surface.

If tubing has to be pulled often in stands, do not break the tubing at the same collars each time, but change the stands by laying down the first joint or first two joints. Excessive breaking of joints causes worn and flat threads which in turn cause parting.

Educational work on the ground at the job with pulling crews will soon result in less down time caused by abuses to well equipment, less pulling time, with a greater number of hours of the wells on production. It is the old story about an ounce of prevention is worth a pound of cure.

Wells by Leases	Gross Production in bbls.	Number days off		Average Daily Production for producing days	Average Daily Production for month	Cause of Down Time	
		of wells	% of days off			Rod and tubing trouble in % of total monthly days	Other trouble in % of total monthly days
Davis No. 1	6063	3	10%	216	196	6% pulling and fishing for rods	4% belt and counter balance repair
2							
3							
4							
Humboldt No. 1							
2							
3							

Interesting Program *for* Natural Gasoline Convention

The annual convention of the Natural Gasoline Association of America includes an exceptionally interesting program. The convention will be held at the Mayo Hotel, Tulsa, Okla. The program follows:

Tuesday, May 20, 10:30 A. M. Frank L. Chase, Lone Star Gas Company, Chairman. President's address, Dr. E. R. Lederer, Texas Pacific Coal & Oil Company. Noon—Dutch lunch, furnished by Natural Gasoline Supply Men's Association. Afternoon session, 2:00 P. M. Specifications, G. M. Davidson, Empire Oil & Refining Company. Comparison of California and Mid-Continent Problems and Methods, California—H. S. Cole, Jr., The Texas Company; Mid-Continent—A. J. Schlosser, Barnsdall Oil Company. Evening—Stag Smoker, furnished by Natural Gasoline Supply Men's Association.

Wednesday, May 21, Refiners' Day—10:00 A. M. W. A. Melton, Deep Rock Oil Corporation, Chairman. Blending Value of Natural Gasoline, E. W. Zublin, Texas Pacific Coal & Oil Company; S. S. Smith, Shell Petroleum Corporation. Natural Gasoline Specifications from the Refiners' Viewpoint, Peter Nolan, Producers and Refiners Corporation. Noon, Dutch lunch, furnished by Natural Gasoline Supply Men's Association. Afternoon session, 2:00 P. M. F. E. Rice, Phillips Petroleum Company, Chairman. Sales paper, W. K. Warren, Warren Petroleum Company. Outage, Emby Kaye, Skelly Oil Company. Evening—Annual dance, furnished by Natural Gasoline Supply Men's Association.

Thursday, May 22, 10:00 A. M. D. E. Buchanan, Hanlon-Buchanan, Inc., Chairman. Report of Research Program, Dr. George Granger Brown, Department of Chemical Engineering, University of Michigan. Noon, Dutch lunch, furnished by Natural Gasoline Supply Men's Association. Afternoon session, 2:00 P. M. Report of Gas Testing Committee, George P. Bunn, Phillips Petroleum Company. Aviation Fuel, R. C. Alden and Billy Parker, Phillips Petroleum Company. Theory of Absorption, A. Kremser, Standard Oil Company of California.

The special features of these fittings are covered by Patent Application No. 315274, Oct. 26, 1928, series of 1925. Method of attaching these fittings onto tubes, by means of a jig, is covered by Patent No. 1746535.

The Latest KEY

Sectional Type Stream Line Flow

RETURN BEND

Quickly dismantled for cleaning of tubes. Has a high factor of safety.

Its design guarantees a minimum pressure drop through the return bends of approximately 25%.

Made of forged steel throughout, except the U-bend, which is made of cast steel. The U-bend is only part subjected to extreme wear, and is easily replaced. Replacement of single tubes is possible without the loss of other tubes.

Key Sectional Type Stream Line Flow Return Bends are made for all operating pressures and temperatures — and for every type of tube and pipe still.

This fitting can be adapted for very small tube centers, and it is possible to form many complicated tube layouts by the use of other special fittings belonging to this series.

Write for complete information on Key Refinery Fittings.

Modern plant equipment and skilled workmen are responsible for Key Fittings. Here is seen a wing of the Key plant, with final inspection benches in the foreground. Each individual operation of Key Fittings is thoroughly inspected before passing on to the next operation.

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Acid-Bottle Well Surveying Equipment

GREAT strides have been made in straight hole drilling in the last two or three years. This is not to be wondered at when the far-reaching importance of having relatively straight holes is realized. To the geologist it means closer correlation of well logs and a more accurate interpretation of geologic structure. To the contractor it means less wear on drill pipe and drilling equipment, with a freedom from mechanical troubles, and consequently better drilling time. For example, ten wells recently drilled in the Maud area of the Greater Seminole field averaged five days less drilling time than the average old Seminole field wells drilled about three years ago, despite the fact that these ten wells were 30 feet deeper than the average old Seminole well. Also they were not more than five and one-half degrees off the vertical as compared with 20 degrees for old Seminole wells.

In deep drilling areas surveying the well every few hundred feet while drilling has become routine practice. With this practice has come the development of numerous types of well-surveying equipment. Acid-bottle well surveying equipment especially has come in for a share of attention. Skill has been developed in making well surveys by this method. Efforts have been aimed at cutting down the time in making readings and to render the acid-bottle method more accurate and foolproof. Changes in the principles underlying the method itself have been few. It is mainly along refinements in the design and construction of the acid-bottle container and the methods of running the container in the well that progress has been made.

Many of the field men, whose duties, among others, include the making of well surveys, have developed equipment and containers to suit their particular field conditions. Three such pieces of equipment that have been developed and used in the field by Geo. L. Nye, Petroleum Engineer, Tidal Oil Company, at Maud, Oklahoma, are shown in the dimensional sketches, Figures 1, 2 and 3.

Figure 1 is a four-inch bailer type of container for running inside the casing.

Reading top to bottom—Acid-bottle container for casing—3-inch pipe (shows acid-bottle container and 3-inch cover which is attached to bottom of joint 3-inch pipe and bail for top of 3-inch joint); one type of acid-bottle bomb for running in casing; showing method of clamping reel on jack post and reeling out from the cathead, using a rope drive (a V-belt drive has also been used successfully); acid-bottle surveying equipment for running in drill pipe, as used by Tidal Oil Company in Seminole district; box for carrying acid-bottle well survey materials, as used by the Tidal Oil Company.

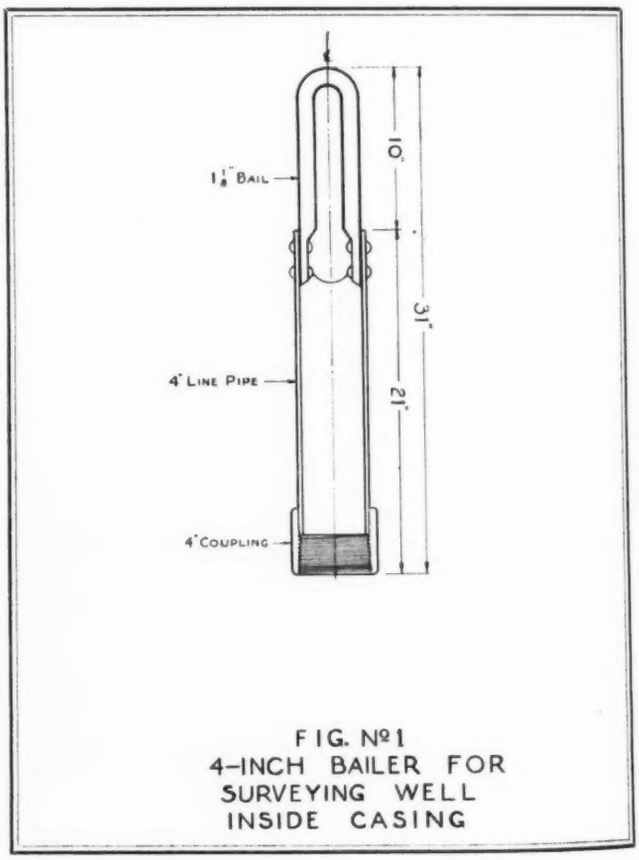
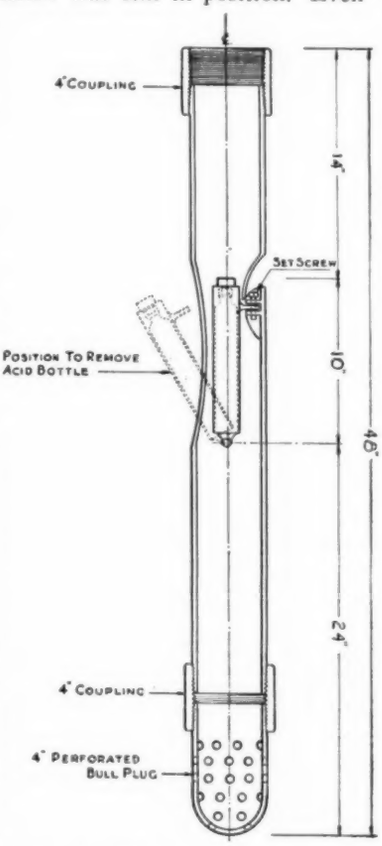


FIG. Nº1
4-INCH BAILER FOR
SURVEYING WELL
INSIDE CASING

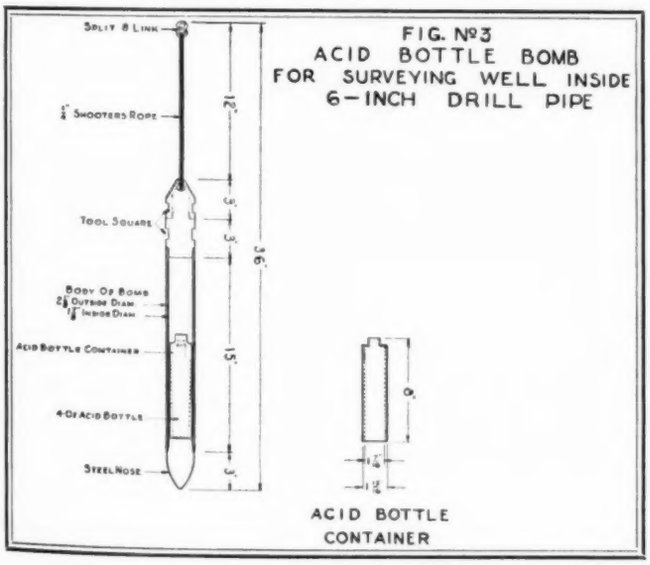
This was one of the early types of containers made. It has since been supplanted by another type. It was found that the four-inch couplings would sometimes stick in the $5\frac{3}{16}$-inch light weight liner with which many of the wells were equipped. Another objection was its weight, as it was made from four-inch pipe.

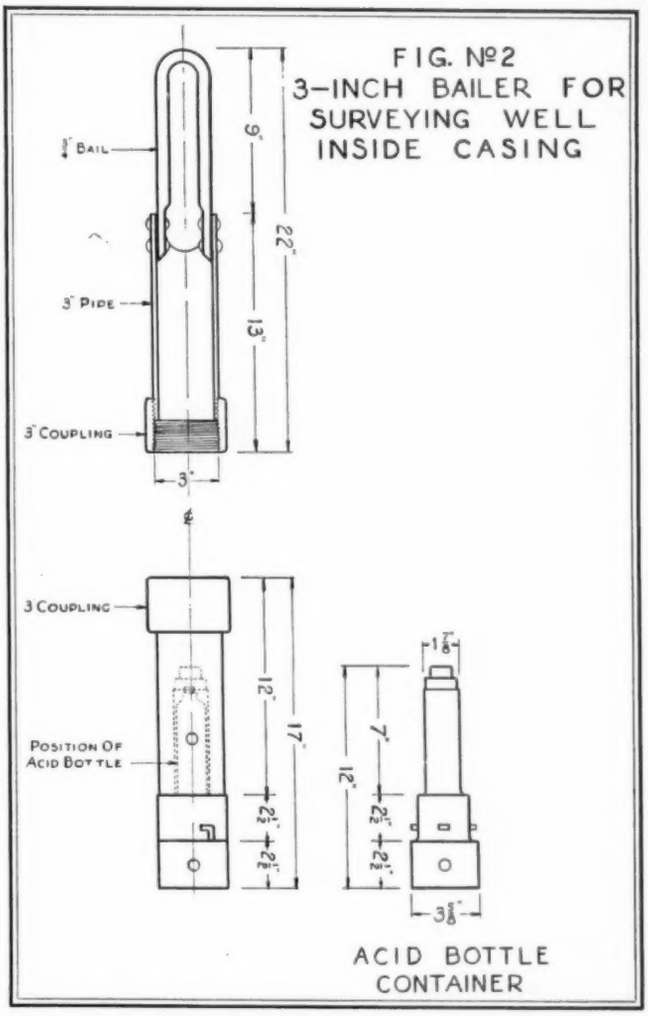
The perforated bull plug on bottom was added so that should the bottle-container pin break it would be prevented from falling to the bottom of the hole. In one instance when running the bailer-container in the well the friction sand reel slipped, speeded up and got out of control, resulting in dropping the bomb about 2000 feet and piling the sand line on top of it. Next day the bailer was fished out. On opening the container the bottle was intact; also, it was found that the container was still in position. Even the set screw holding the container did not loosen. This bailer type is designed to run in 10-inch, 8-inch, $6\frac{5}{8}$-inch and $6\frac{1}{4}$-inch casing.

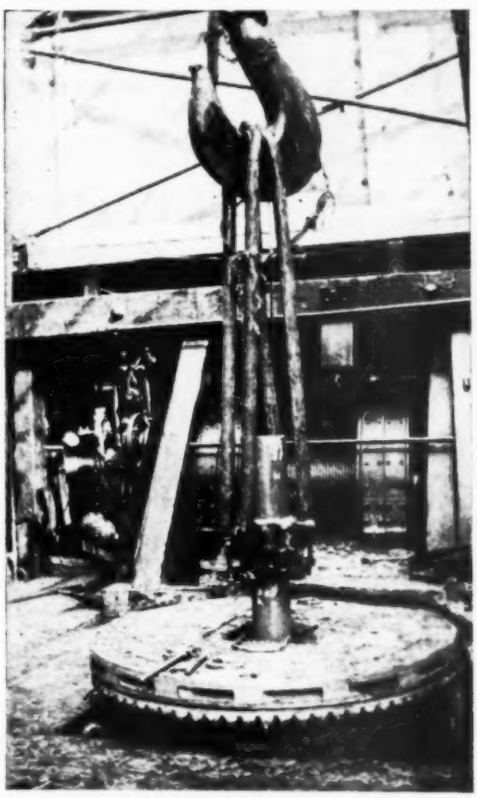
Fig. 2 shows the details of a three-inch bailer acid-bottle container, designed to run in 10-inch, $8\frac{1}{4}$-inch, $6\frac{5}{8}$-inch, $6\frac{1}{4}$-inch or $5\frac{3}{16}$-inch casing on the sand line. No extra equipment is necessary at the well other than a joint of 3-inch pipe, which usually is conveniently available. When made up the bailer is about 22 feet long. It should be noted that the bottom of the bailer is made from a sand pump bottom with an acid-bottle container welded on top. For field use the bailer is most portable and easily handled, as only the top with bail and the bottom with container need be carried around. Also, the acid bottle is held in a positive position.



View of acid bottle bomb for running in casing.







Running acid bottle container in drill pipe. Note pulley attached to bottom of elevator hook.

THE superior strength of "IDECO" structural steel derricks, through sound engineering, is attained with from 30% to 60% fewer parts than any other derrick on the market. Every brace, girt, bolt and rivet has a definite part in the design, yet at no place is the shearing value of a bolt or rivet a determining factor in the structure. Every joint is a positive connection. There are no friction joints, special bolts or complicated clamps or fasteners.

Exit Price Buying—

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Perhaps it's just human nature that folks refuse to look ahead. Put your money in long pull investments . . . buy IDECO Galvanized steel equipment at all times!

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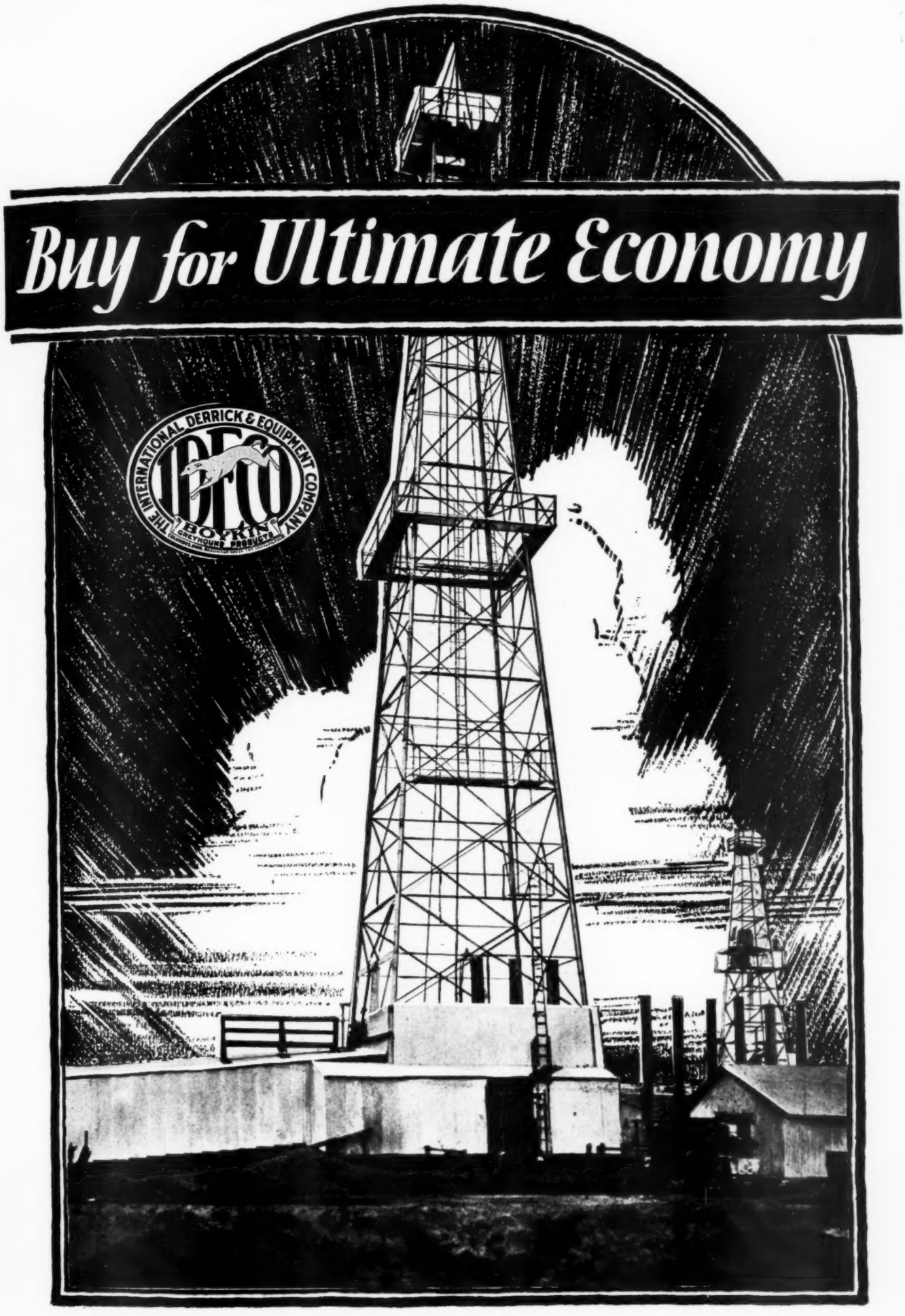

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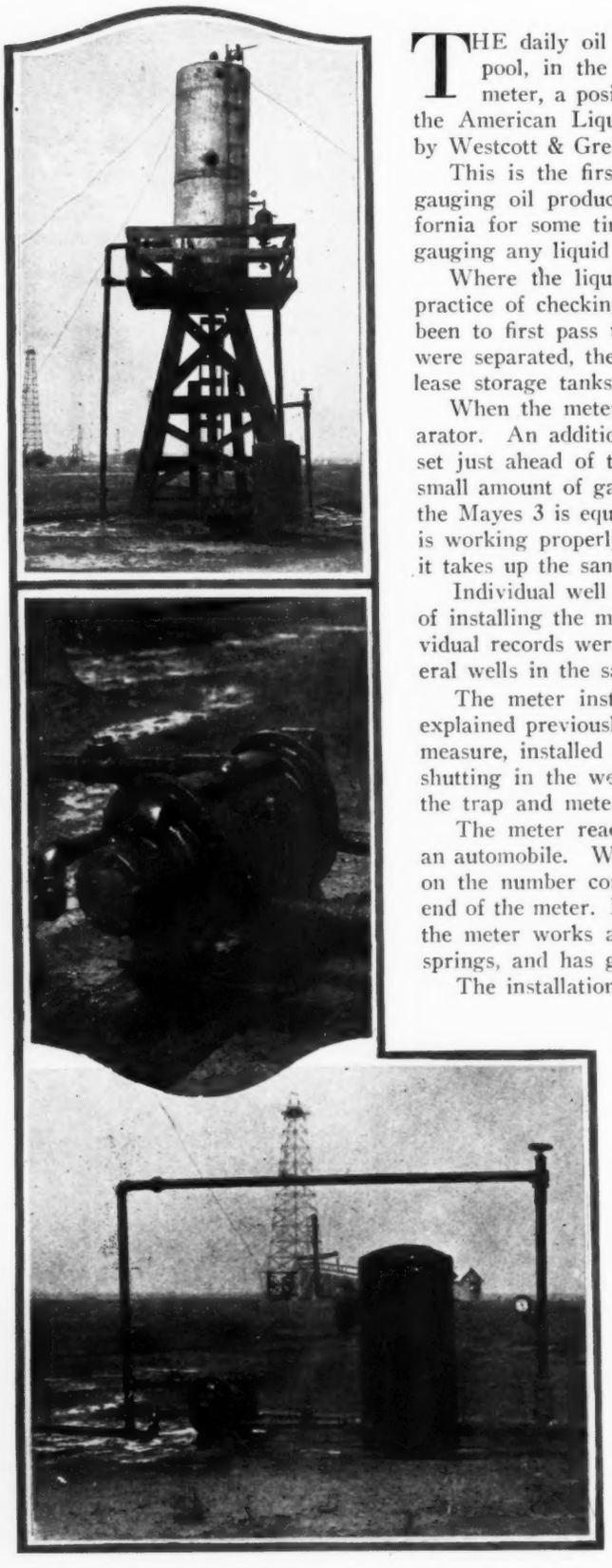
New Method Introduced When

LIQUID METER GAUGES «« OIL WELL FLOW »»



Reading top to bottom—Photo illustrating compactness of installation; the meter; general view of the installation.

THE daily oil production of the Skelly Oil Company's Mayes 3, Earlsboro pool, in the Greater Seminole, Oklahoma, is gauged by a Bassler liquid meter, a positive displacement type of liquid meter. The meter is made by the American Liquid Meter Company of Alhambra, California, and distributed by Westcott & Greis, Inc.

This is the first time such a meter has been used in the Mid-Continent for gauging oil production, although the system has been in extensive use in California for some time. Many other uses have been made of the meter, such as gauging any liquid from molasses to natural gasoline.

Where the liquid meter is used there are several changes from the general practice of checking oil production. The universally used system on a lease has been to first pass the oil through one or more gas traps where the oil and gas were separated, the gas going into the gas-gathering system and the oil into the lease storage tanks, where it was measured.

When the meter is used, the oil is gauged immediately after leaving the separator. An additional gas eliminator, as used by Skelly, is a miniature gas trap set just ahead of the meter. It is the function of this apparatus to remove any small amount of gas that may have escaped the separator. The small gas trap on the Mayes 3 is equipped with a float valve, which pops into the air when the trap is working properly. The gas must be eliminated when the oil meter is used, as it takes up the same space as does oil.

Individual well records were not kept on the Mayes lease previous to the time of installing the meter. Several wells were flowing into the same tank and individual records were impossible. The meter offers the opportunity of running several wells in the same tank and still obtaining an individual well record.

The meter installation consists of the gas eliminator and safety valve, as explained previously, and a horizontal by-pass. The horizontal by-pass is a safety measure, installed so that the meter or trap may be repaired or replaced without shutting in the well. The fluid is simply passed through the by-pass instead of the trap and meter.

The meter reading is very simple, looking very similar to a speedometer on an automobile. When a cylinder in the meter has become filled it exhorts pressure on the number controller, which then registers the oil volume in barrels at one end of the meter. Regardless of the difference in the rate of oil flow from the well, the meter works accordingly. The meter has only seven moving parts, with no springs, and has given no trouble.

The installation is equipped to make temperature readings and sample readings of the fluid. A thermostatic control automatically regulates the contraction or expansion of the oil and registers it at 60 degrees F. An automatic continuous sampling device tabulates the gravity of the oil and water content. These devices eliminate the checking of the temperature, gravity and water content. The meter, according to E. H. Cain, engineer for the Skelly Oil Company at Seminole, measures very accurately as long as the gas eliminator works properly. A check has been maintained between the readings of the meter and those of a gauge stick, and the two have been found very close.

The Mayes 3 is a pumping well averaging 175 barrels of fluid per day, of which about 55 per cent is water. The water is measured as oil in the meter and must be deducted from the total figure. The well is making around 25,000 feet of gas daily.

Previous to the time of installing the meter on Mayes 3, it was used on the Skelly Oil Company's Sheperd 1, at Seminole. This well is a gas lift producer making about 2,200,000 cubic feet of gas and 600 barrels of fluid. A larger gas trap was used than on the Mayes 3 to care for the bigger gas production. The meter was able to register quite accurately the production from this well, despite the use of gas as a lifting power.

Considerations in the DESIGN *of the* DEWAXING PLANT

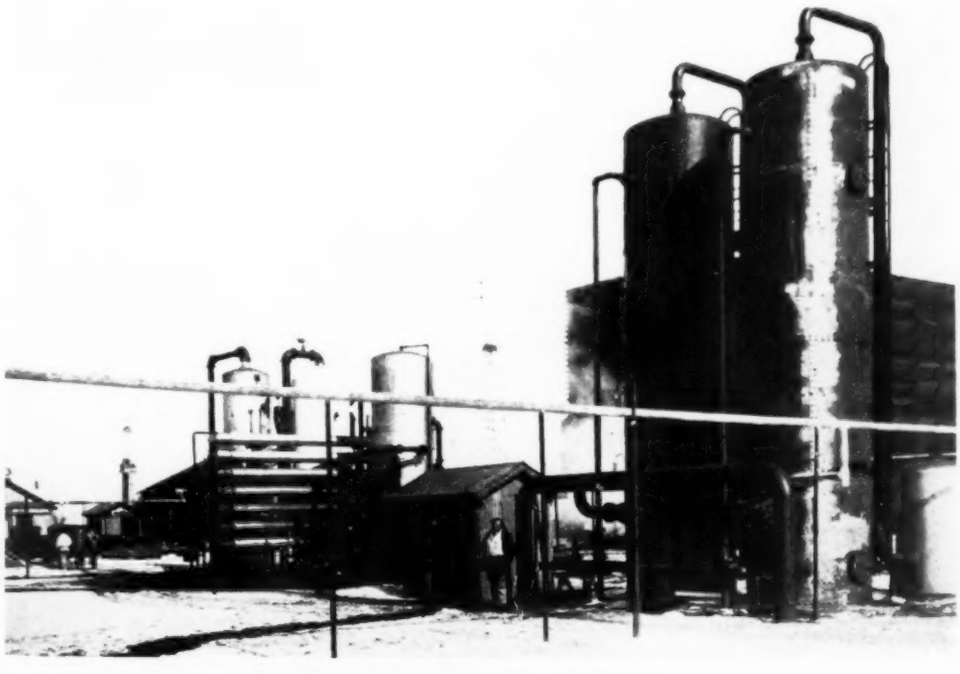
IN the design and general layout of the centrifuge plant, many factors have to be considered which influence the arrangement and relative locations of the units. In addition to the general considerations, such as drainage, expansion, accessibility, etc., which are applicable to the construction of any unit, the centrifuge plant involves the consideration of special points peculiar to this operation.

Heading this list of special considerations is the question of fire hazard. Although the percentage of fires originating in these plants may not be above average, it should be borne in mind that a definite set of hazards exist in the operation of the plant. Recent developments in the design of the centrifuge have reduced this hazard considerably, but, of course, have not entirely eliminated it.

Probably the one factor contributing most markedly to this condition is the presence of quantities of naphtha vapor in the room housing the machines. Proper and efficient ventilation of the room, whereby these vapors are removed and not allowed to accumulate in pockets, reduces the probability of trouble to a great extent. Such ventilation can be best accomplished by using a large closed suction fan (driven by a vapor-proof motor), the intake side of which is connected to a large duct suspended from the ceiling over the lines of machines. Over each machine is suspended a hood or inverted cone, the small end of which is connected into a tee connection on the header. By regulation of suction pressure and finding the optimum position of the hood by trial, all vapors from the three principal sources are drawn into the header, through the fan and out to be dissipated into the air. The principal sources are the wax spout and dewaxed solution spout, and the hole in the two pans through which the bowl drive spindle passes. In a centrifuge room thus equipped a non-explosive atmosphere is found with a combustible gas indicator. Previous to this installation a three-quarter scale reading could be obtained in almost any part of the room.

One refiner has installed his centrifuges in a structure having a roof but no sides, depending on the wind to dispense the vapors. Such an arrangement functions fairly well except when there is no wind or when it is obstructed. At this plant there is a marked tendency on the part of the operators to slight their work in winter while seeking a warm spot.

Another source of naphtha vapors and naphtha solution is the opening at the bottom of the machine through which the feed nozzle is fitted. In some plants the same procedure has been adopted to accommodate this drainage. A concrete trough about four inches wide and four inches deep is cast in the concrete floor. In every case the fall in this trough is insufficient to insure rapid and complete drainage. Wax runs out of the machines at times, gets into the trough and solidifies, backing up the drained solution and pocketing it. Water frequently finds its way to the drain trough, freezing at times and effectually preventing



Distillation unit and absorbers at an Oklahoma plant.

drainage. Such a condition is dangerous, in that it provides a path for fire to travel down the whole line of machines, endangering all machines in case of a local flash. This hazard can be removed by installing a galvanized iron drip pan under each machine, having them drain into a two-and-one-half or three-inch header, which is installed in place of the open concrete trough. This header should be trapped, as should all drain lines, before entering the slop tank. At reasonable intervals steam connections should be left for thawing-out purposes.

The location of the gravity feed tank opens another question which influences the existence of fire hazards. The general practice in the past has been to place the tank as close as possible to the machines. As elevations above the machines are necessary, and frequently the building which houses the machines lends itself to the support of the tank, it is placed inside of the building in the same room as the machines. It is suggested that this be avoided if at all possible. An ideal location is outside of the building on a separate fire-proofed steel support. Erected in this manner, the 50 or 60 barrels of naphtha solution are out of and away from the danger zone. This method of installation facilitates fireproofing of the tank and the installation of remote controls operable from a point removed from the fire zone.

Today we are taking wealth from nature. Science is showing how it can be done and industry is doing it. The alliance between science and industry is producing new wealth for the benefit of all. There is more time for the individual to develop himself than ever before. ***—Walter S. Gifford.***

The building itself should be of fireproof construction. A very acceptable design calls for concrete floor, steel framing, hollow tile walls and compressed asbestos corrugated roofing. If the designer is not cramped for space, the building should be only one story high. Many installations are two-story structures, the bottom floor housing pumps, separators, traps and wax separator. This arrangement is economical in that it requires less piping and less ground space.

Arrayed against these economies are several obvious disadvantages. Fire can be more easily fought in a one-story building. Operators in case of a serious fire are insured an opportunity for an easy and speedy exit, and at such times split seconds count. The first floor containing, as it does, solution pumps and wax separator, is a potential source of naphtha vapors, and consequently constitutes a fire and explosion hazard. Leakage from the concrete floor above eventually permeates or leaks through cracks to the floor below, dripping on pumps and motors — a circumstance not in keeping with good practice.

In short, the building or room housing the centrifuges should be as isolated as possible, with every precaution taken to gas and vapor pockets. Care should be taken to install remote control valves on all lines in and out of the plant operable from a safe distance. Hazards, such as exposed tankage near the plant, are to be avoided. Counterweighted windows and doors held open by fusible links are essential. The complete complement of carbon tetrachloride and foam extinguishers and steam smothering lines are, of course, considered as standard equipment. Such elaborate precautions may seem superfluous, but weighing them against the initial cost of, say, a dozen centrifuges, leaves room for reflection on the part of the executive.

The electric lighting equipment of the plant can be installed vapor-proof by use of Underwriters vapor-proof fitting. The use of vapor-proof driving motors is now being given serious consideration by some engineers. The extra cost of these has to be weighed against the reduction in hazard.

The power controls recommended on the motors is the standard type of oil-immersed triple pole manually-operated switch, equipped with low-voltage release and overloaded relay. At this point it is suggested that the oil in the switches be tested for flash point periodically. Absorption of naphtha vapors occurs while in service. After two months' service in one plant the switch oil was found to have a flash point of under 200 degrees F.

A master switch oil-immersed type with push-button stations at strategic points is suggested for an emergency cut-off in case of fire, by means of which all power to the centrifuges may be cut off. In between this switch on the main feeder and the machines should be a circuit panel board with individual switches and fuses for each motor. Such a provision permits making repairs on single motors safely.

Another hazard noted in several plants was the procedure employed in cleaning centrifuge bowls. An oil drum with the head cut out was filled with naphtha and the bowls inserted and cleaned with a round brush manually. A distinct improvement on this method is to use a galvanized iron box of two compartments, each one large enough to accommodate a bowl on end. The doors on the front are hinged and fitted with a wing nut clamp, used to compress a felt gasket securing vapor tightness. Inside on the bottom is a nozzle through which is pumped naphtha, or through which steam can be blown. Naphtha is supplied by a small electric-driven centrifugal pump. The top of the box is connected to the vapor recovery system. Drains are connected to the bottom, which carry the wash naphtha and dissolved wax to the wax separator.

In operation, the bowl to be cleaned is removed from the centrifuge, drained, inserted in the box, the nozzle projecting into the bowl, the bowl and door clamped in place and the steam turned on. The wax cake and solids are steamed out and the bowl then washed with naphtha through the spray. The whole operation can be performed in two or three minutes, whereas the old barrel and brush method took 10 or 12 minutes. A small saving in operator's fatigue, perhaps, but, in addition, the removal of a definite hazard in the open barrel of naphtha.

Due consideration should also be given the relative locations of the centrifuge building and the chilling tanks. Too great a distance means loss of refrigeration and too close means added exposure to a large investment. A balance must be struck weighing exposure against loss of operating efficiency. At a few degrees below zero the loss is not so noticeable, but as the temperature decreases to the ranges now employed in low cold test production, the power curve mounts rapidly every degree lowered. In the layout of lines to and from the plant, and especially those handling cold solutions, it cannot be too strongly recommended that an abundance of water draw off connections be provided as well as thawing out connections. At the bottom of every vertical run of pipe a tee should be placed, the third opening pointing down for steam connections.

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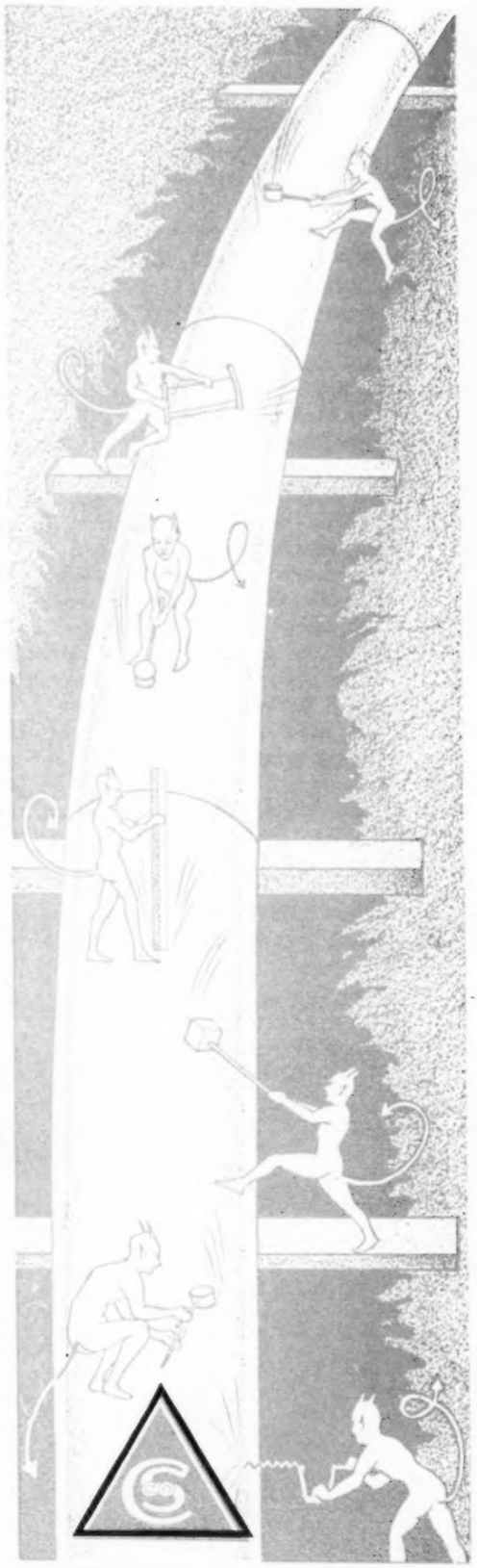

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Making Use of PORTABLE WELDER

NEW type of arc welding generator, built to the chassis of a truck and driven by the truck's motor through a power take-off, is being used extensively in the Mid-Continent, particularly as a "trouble shooter". Two Mid-Continent transporters are building up fleets of the units that have thus far proven valuable for their portability and adaptability.

For pipe line use a one-ton, six-cylinder truck is used with most machines, although some of the units are built on larger capacity trucks. The generating unit requires only 14 inches of body space and is built in between the driver and passenger seat in the cab. Its gross weight, including accessory equipment, is around 1,000 pounds.

The Shrader Electric Co. of Los Angeles designed the arc welder, which uses a 400-ampere, 25-volt, 950 r. p. m. generator. The generator delivers 300 amperes continuous direct current, or 400 amperes intermittent. The engine operates at 1,000 to 1,050 r. p. m., or the equivalent of approximately 20 miles per hour if operated on the road at the same engine speed.

The generator is self-exciting and designed to produce a smooth, steady and non-sputtering arc. With a smooth arc the welder obtains an even flow of metal and a non-oxidized weld free of pores. The reactor coil is designed to give deeper penetration and make the arc hit off the center of the rod. The generator is controlled by an automatic electric governor operating direct on the carburetor and permits the engine to turn over just rapidly enough to deliver the necessary power which is predetermined by the operator.

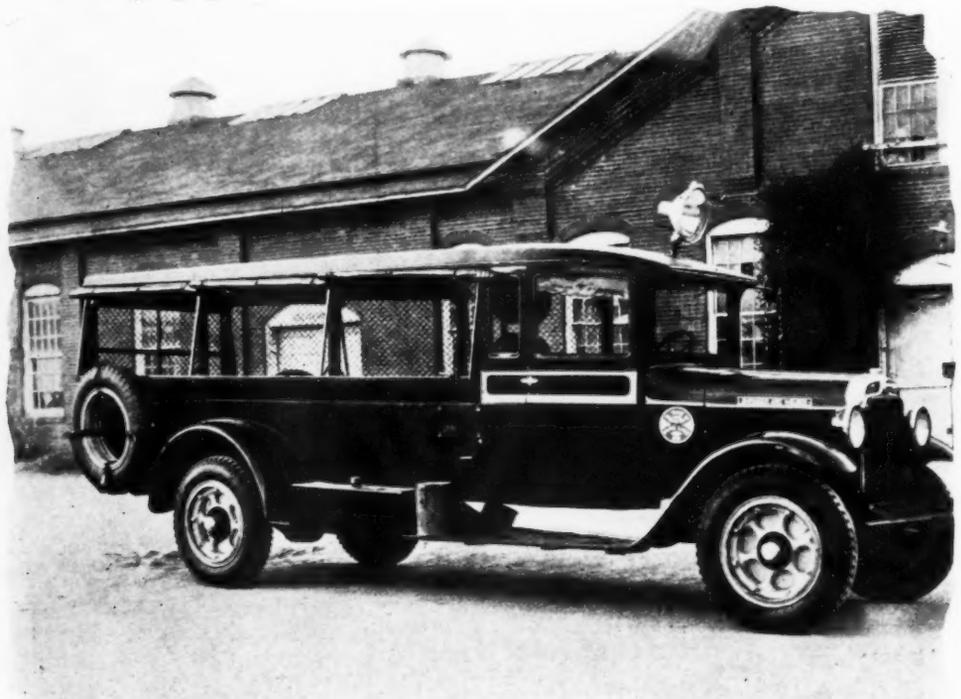
The generator is mounted on a specially designed frame built into the chassis directly under the driver's seat. With reference to the cab, it is located in the center and lengthwise, parallel with the shaft. A Detroit universal joint is flanged to the transmission flange and the power take-off is set in directly behind the universal joint. The power take-off operates the generator through a chain drive.

The remainder of the arc welder equipment is located directly behind the driver's seat and takes up only 14 inches of bed space. This part of the assembly is sheathed in with a removable metal housing. The cable reels are built to the truck bed and directly behind the enclosed assembly. All of the remaining space of the truck bed is utilized to carry tools, etc.

On the Prairie Pipe Line Co.'s fleet of welders each truck is equipped to care for virtually any emergency that requires welding. The 20-gallon capacity gasoline tank is mounted on the running board, insulated and sheathed with sheet metal. On the other running board, shop-made receptacles, built with pipe and equipped with latches for locking, carry signal oil lanterns to set around the truck in the event it has to stop by the roadside at night for repairing a line break.

Spare tires are in tire wells built to the side of the truck, just over and behind the rear fender. Each truck is totally enclosed with heavy steel wire which permits keeping the equipment under lock. The body is lighted with two small lights in the front end over the welder. A 250-watt flood lamp is mounted on top of the cab and can be adjusted to any position from the inside of the cab. On the side of the truck body are a couple of connections that can be plugged into to operate drills, hammers, grinders or additional lights. The generator supplies 1½ K. W., 110-volt alternating power for the lights and accessory equipment.

With the ample body space remaining in the truck the company plans to load gas cylinders, hose and cutting torches to be used whenever that type of work is required. The remainder of the space will be taken up with tools and supplies



One of the Prairie Pipe Line trucks used to transport the welding equipment.

for PIPE LINE WORK

for repairing breaks. Standard equipment consists of 500 feet of 00 rubber-covered cable, 100 feet of which is wound up on one of the two reels and the remaining 400 feet carried on the truck in coils. If an additional 100 feet is required, a ground can be made and the 100 feet of cable on the reel may be used.

As much as 1,000 feet of cable may be carried on one truck for welding on tank farms. With this, the truck can be parked outside the fire limits while the welding work is being done. An extra helmet and extra holder are also carried.

The trucks will be stationed at advantageous points along the line's right-of-way so as to be able to proceed to a break in the line with the least possible delay. These locations will probably be at shops where the unit may be utilized when not in service out in the field.

With flood lights and extra light attachments sufficient light is afforded the repair crew digging up the line to proceed with their work more rapidly. The lights also are used for illumination while the repairs are being made by the welders.

It is planned to use the units extensively on rush construction jobs where they can be utilized for night work as well as work on the line during daylight hours. Because the trucks can go virtually anywhere in the field under their own power, another company is planning to use them on new construction work. This company, which built the welder into a heavy-duty truck, has installed an additional gasoline-driven generator in the rear end of the truck bed.

This unit was one used in routine duties and the steel frame on which it was mounted was bolted to the truck bed. Thus the transporter has two arc welding machines on one truck, permitting welders on the firing line to work in opposite directions concurrently from one set-up. This truck is also equipped with lighting accessories and other small equipment.

The compactness of the unit, along with the rigidity with which it is mounted on the truck, has reduced road shock and vibration to a minimum. With the light trucks which can be driven around 45 miles per hour on the road, the emergency crews are able to establish new records in repairing line breaks. All of the necessary equipment, including a joint of pipe as well as the entire crew, can proceed to the point of trouble at the same time and with greater speed. If necessary to carry more equipment or pipe, it may be sent on another truck while the crew proceeds.

Starting and operation of the welder is a simple process. The truck motor is started, the emergency brake released and the wheels blocked to hold the truck in place. The clutch is pushed out and the gear shift put in low. Then the lever on the generator is moved forward until it engages the driving gear. The foot is taken off the clutch pedal and the generator starts turning over. Without speeding up the engine, the clutch is again pressed out and the gear shifted to high and the clutch released.

The engine speed is set by turning the small wheel located on the dashboard. When the motor is turning over at a speed sufficient to register about 20 miles per hour the voltmeter will register around 40 volts, but should not exceed this. The amperage is set by moving the dial located in the same assembly with the speed governor or governor wheel on the dash. It is turned to the amperage wanted and is marked with numerals indicating the amperage at various positions. It has a range from 25 to 400 amperes.

The grid control has three points: medium, high and low heat. Usually the gasoline tank has to be moved and the seat in the cab has to be rebuilt.

Making a night weld on a line under pressure.

Concrete Foundation Assists in Reducing Vibration on Pumping Wells

Top—General view of the unit. Directly above—Close-up of one corner of the rig, showing how the rig was set in the concrete.

A STURDILY constructed pumping unit on the Comar Oil Company's No. 17 Beverlin, Tonkawa, Okla., field, is considered one of the steadiest pumping units, as well as neatest pumping rigs, in the field. It has several unique construction features that make it very interesting.

Last summer an old pumping rig on the location burned when struck by lightning. C. M. Copeland, district production superintendent, in constructing another rig in the place of the destroyed one, tried to build as near a fireproof rig as possible. He not only succeeded in this, but also in erecting a sturdy, solid unit that has proven exceptionally efficient.

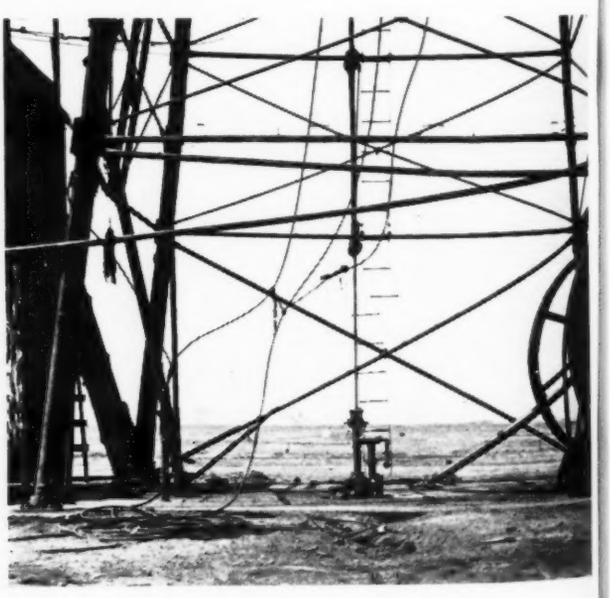
One of the outstanding features is the lack of inflammable material. A steel pumping rig was set and bolted fast to a solid poured concrete floor when the latter was fresh and soft.

The concrete floor is laid right on the ground, eliminating any cellar. The floor has been sloped to the center from all four corners. In the center of the rig floor is a pit into which all wastage may drain, thus making it possible to keep the location neat and clean. This pit is sloped to one corner from which a drain pipe carries all waste material away from the location.

All pipes, including flow lines and the above-mentioned drain pipe, were buried in the concrete when it was poured, therefore the derrick floor is clear of obstacles. Most of the Christmas tree connections are in this pit; the remainder stick up but slightly above the level of the floor.

The company machine shop in the field came in handy, as bullwheel posts and braces and other equipment on the pumping rig were fashioned in it from discarded pipes.

This well probably has less down time than any pumping unit in the field. It is well counterbalanced and is equipped with an idler for taking up any slack in the bandwheel belt.



General view of the rig floor.

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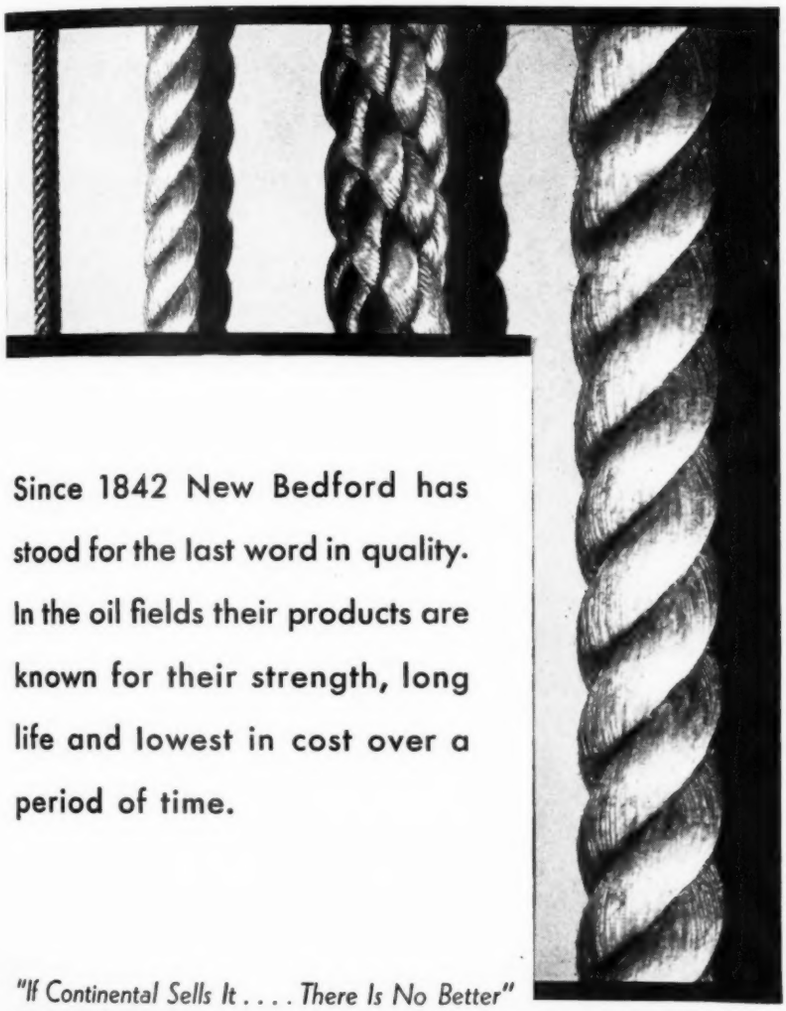
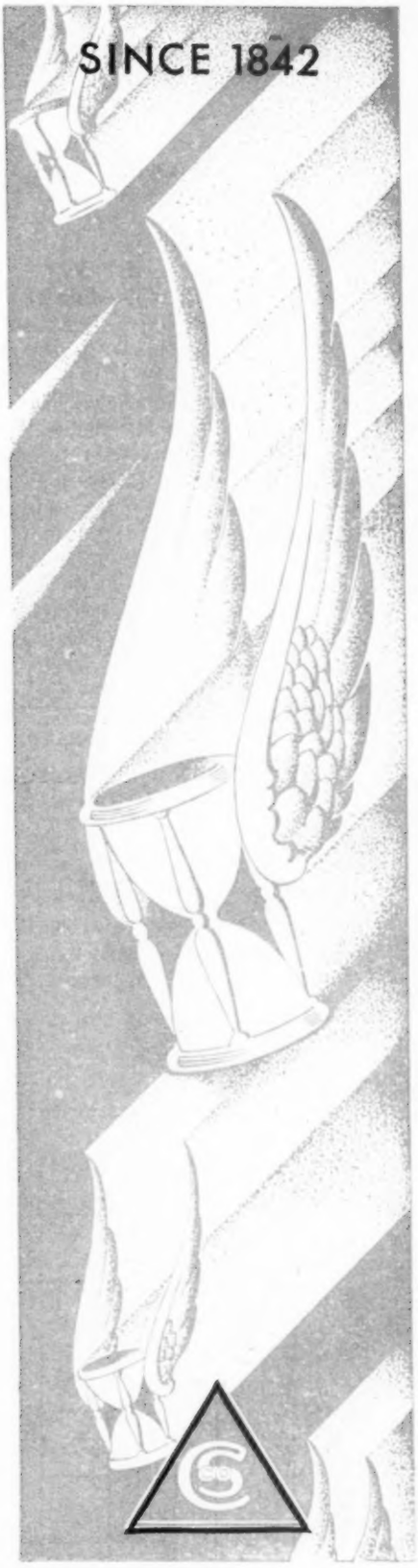


Since 1842 New Bedford has stood for the last word in quality. In the oil fields their products are known for their strength, long life and lowest in cost over a period of time.



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Drilling *the* World's Deepest Oil Wells

By HAROLD VANCE[1]

THE discovery of 56-degree A. P. I. gravity oil in the Group One Oil Corporation's University B-1 at 8523 feet marked a real accomplishment in the drilling of oil wells at that time. This well, located in the Big Lake field, which is entirely University land in southern Reagan County, discovered oil in what has been recently identified as the Ordovician, more than 5000 feet below the usual West Texas producing horizon. Faith, perseverance, ability and no small amount of good luck were responsible for this discovery. This well, like many wildcats, is not in the best condition, although it has produced over a million barrels of oil to date. Two pay horizons, one at 6500 feet and the other at 8500 feet, are produced through the same string of casing. This is owing to the fact that the 5⅜-inch casing was set at 6184 feet and it was thought advisable not to disturb it or run a smaller string. The oil from the 6500-foot pay gradually filled the hole and made several flows while drilling from 6500 feet to 8523 feet was still in progress. Although it was not realized at the time, the very presence of this column of oil in the hole probably prevented a difficult fishing job by taking the shock off the tools when the deep pay was struck.

Drilling in with rotary after drilling to the top of the sand with cable tools.

It has not been safe to pinch the well back on account of the light casinghead connections, and it has been allowed to flow wide open, during which time the production increased from 140 barrels of oil and about 3,000,000 cubic feet of gas a day to a peak of over 3000 barrels of oil and 29,000,000 cubic feet of gas daily.

Six deep wells have been started since the discovery well came in — two by the Group One Oil Corporation and four by the Big Lake Oil Company. Big Lake No. 2-C and No. 4-C are now

[1] Consulting Petroleum Engineer.

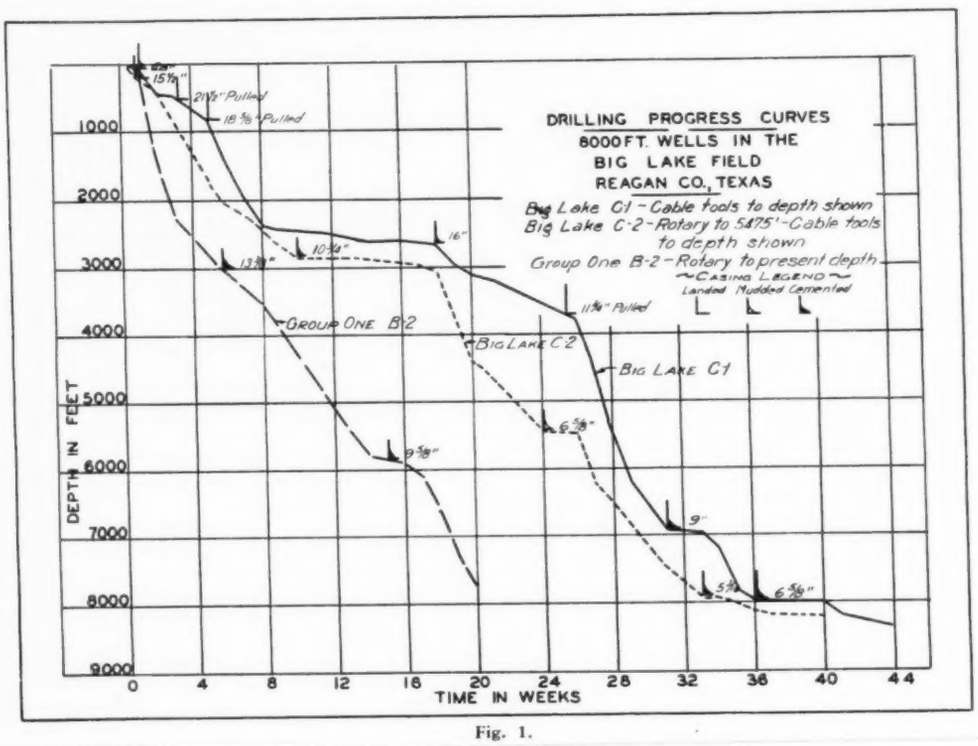
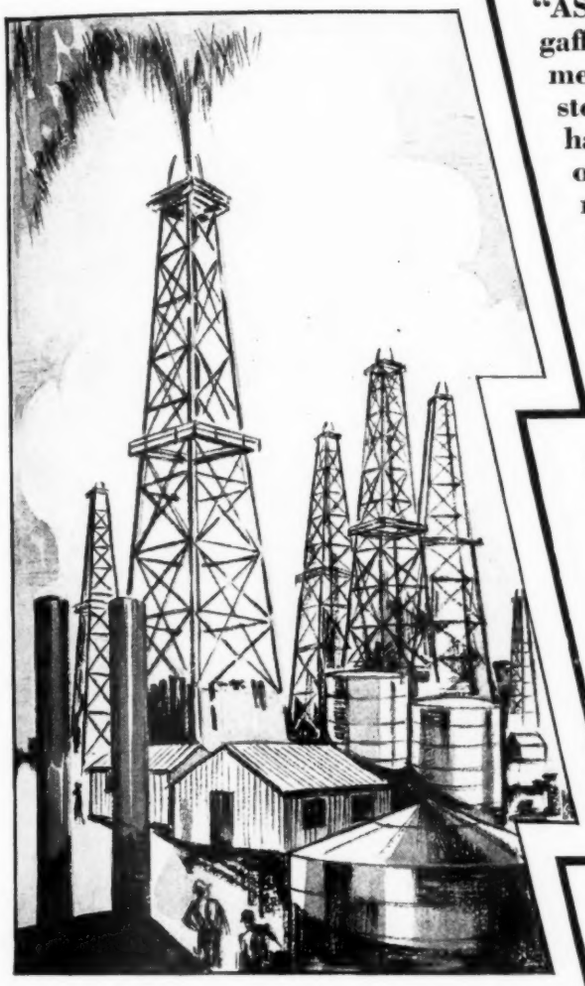


Fig. 1.

Cuts through formations in record time. . .



. . . Drilling tools made from "ASCO" Steel will stand the gaff. Tough formations are easy meat for these tools because the steel from which they are made has the desirable characteristics of holding temper under the most severe abrasion. They will continue to operate when tools made from inferior grades must be pulled and dressed — a time factor that proves very costly in the drilling operation.

Experienced drillers tell us— the one sure way to show record performance is to take the guess-work out of tool purchases—be sure the steel from which the tool is made will do the job without constant attention — specify the type of tool for that particular purpose — then put them in the rig and keep them going.

There is an "ASCO" product for every need in the oil and gas industry — we have been specializing in steel for this industry for over twenty years and our metallurgists have solved many complexing steel problems. They will be very glad to assist you in any way to select the right grade of steel for your tools.

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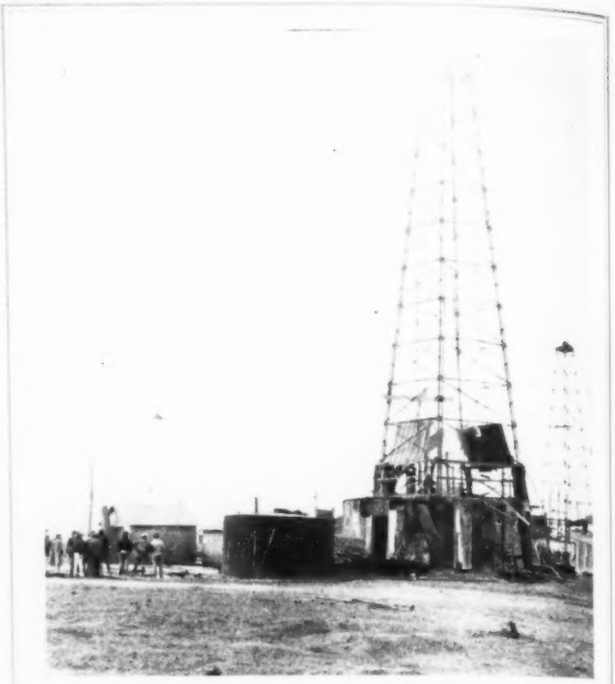
on production. No. 2-C, at a depth of 8233 feet, had an initial production of 190 barrels of oil in eleven hours with about 7,000,000 cubic feet of gas. No. 4-C made 195 barrels of oil and 4,500,000 cubic feet of gas per day at 8220 feet. The Group One Oil Corporation is drilling with rotary and has contracted the work to Loffland Brothers. Two of the largest rotary rigs manufactured are being used on these wells. Four 150-H. P., 250-pound pressure boilers are being used to supply steam for each well. These two wells were started with the rotary despite the trouble encountered by the Big Lake Oil Company in drilling its No. 2-C to 5475 feet, at which depth they changed to cable tools. In drilling this well the 10¾-inch casing was undoubtedly set above the old producing horizon, which, having been partially depleted of its original pressure and being very porous, took the drilling fluid very rapidly. This well was drilled from a depth of 2865 feet to 5475 feet without circulation. Considerable time was spent in attempting to obtain circulation, but without results.

In drilling Group One Oil Corporation's University B-3, an offset to Big Lake Oil Company's No. 2-C, no circulation was lost to the depth of 3026 feet, where the hole was reduced and the reduced hole drilled to 3226 feet, in order to be sure that the casing was being set below the upper porous horizon. This reduced hole was drilled without losing circulation and 13⅜-inch casing was set and cemented at 3026 feet. In further drilling, considerable loss of fluid occurred at 4756 feet. A string of 9⅝-inch casing was set at 5914 feet and, since that time, about 500 feet of hole a week has been made (see Fig. 1).

Mechanical difficulties, encountered in drilling Group One Oil Corporation's University B-3, have caused considerable delay. While drilling at 2990 feet a tool-joint twisted off at about 900 feet from the top. Forty-five days were spent in fishing, but without results. Finally a whipstock was set and it was possible to drill by and cement a string of 13⅜-inch casing at 3077 feet.

A number of acid-bottle surveys were made during the drilling of these two rotary wells. University B-2 was off vertical a maximum of eight degrees at the point where the whipstock was set. University B-3 showed a much smaller deviation.

Group No. 1 University 2-B. This rotary-drilled well holds the drilling record for the 8500-foot pay in West Texas.



"Bringing in" Big Lake Oil Company's deep well University 4-C, in the Big Lake field, Texas.

Mud is an expensive item in drilling with the rotary in this locality, as it must be shipped in from El Paso, Texas. The loss of circulation adds to this cost. Operators and rotary contractors in the Hendricks field in Winkler County, Texas, gained considerable experience in taking care of wells of this character. The first essential is a good heavy mud to start with. Thinning of this heavy mud has caused circulation to be lost at a point where it was already mudded off. The speed of drilling is somewhat retarded by the use of heavy mud, because of the decrease in the pump capacity. One operator in the Winkler field gained circulation on several occasions, when he knew it was being lost at the bottom of the hole, by placing some caliche at the bottom of the hole and shoving it back into the wall with the drill pipe.

The fact that circulation was not lost while drilling through the upper pay in the Group One Oil Corporation's B-3 cannot be laid entirely to the contractor's method of handling the well. It is common knowledge in the West Texas fields that porosity varies both vertically and horizontally, and it is quite possible that this old producing porous zone was "tight" at that point and very porous at the Big Lake 2-C location.

In Fig. 1 drilling progress curves are shown of three deep wells in the Big Lake field. Big Lake Oil Company's 2-C was drilled with rotary tools to 5475 feet and with cable tools to the top of the pay. Group One Oil Corporation's 2-B was drilled with rotary tools to its present depth. This chart not only shows the drilling time and depth, but a complete casing record. It will be observed that in this field there is very little difference in the actual amount of casing left in the hole with the rotary method as compared to the cable-tool method. There has been a considerable saving in time in drilling Group One Oil Corporation's 2-B with the rotary to its present depth, and should this saving continue to its total depth, only about half the time will be

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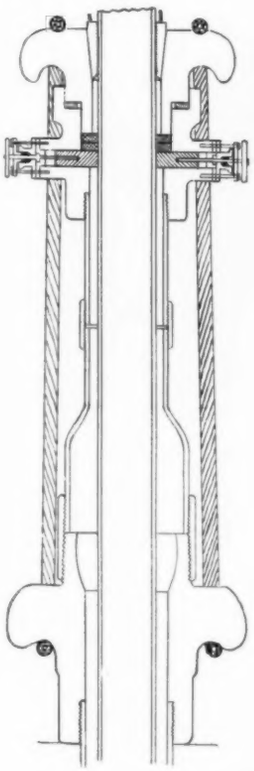

THIS unit is adjustable to accommodate emergency developments and can be installed and dismantled by ordinary operators.

To control and regulate excessive volumes and high well pressures encountered unexpectedly in the process of drilling deep wells through conversion to one continuous string of well casing, remove top and center sections (No Bolts) and connect sub nipple or joints of well casing to threaded lower part of head, which is connected to the anchored or cemented surface string of casing.

This Hook-up prevents the loss of oil or gas while bringing in new wells, through pressure control.

Packing mechanism is positively accurate in operation.

Split casing rings can be placed around the casing or pipe while suspended between the top and bottom points of suspension above the surface line in the same manner as ordinary casing clamps.

Lug construction affords easy handling with casing outfits and elevator links; starts long strings of casing easily.

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consumed in drilling this well of that necessary in drilling Big Lake Oil Company's No. 1-C. However, in the case of Big Lake Oil Company's No. 1-C, a somewhat larger casing program was used. Excellent time has been made with cable tools from 3750 feet to 7000 feet. Much better time was made in the case of Group One Oil Company's No. 2-B to 3750 feet than in the case of any cable tool holes. There was also a considerable saving in the amount of casing run. This is accounted for by the presence of a heaving sand encountered above the top of the lime, which causes trouble while drilling with cable tools.

It is believed, with a combination of the rotary and cable tools, these deep wells can be drilled cheaper and more quickly than by any other method. Rotary can be used from the surface to a depth of 3700 feet, cable tools from 3700 feet to 8000 feet and rotary again for "drilling in." Three strings of casing would be necessary, besides a few joints of surface pipe. It might be possible to drill the well with two strings besides the surface pipe if 11¾-inch casing could be set at 3750 feet and 6⅝-inch casing at 8000 feet.

The Big Lake Oil Company has adopted the following casing program for its cable-tool holes:

15½-inch at	500-600 feet
12½-inch at	900-1000 feet
10 -inch at	2600-2700 feet
8¼-inch at	3700-3800 feet
6⅝-inch at	8000 feet

With this program it will probably be possible to pull and recover the 15½-inch and the 12½-inch casing.

Very good core recovery is being obtained with the use of a core barrel. Formation being cored consists chiefly of brown and dark gray sand and sandy shale. Very little accurate correlation has been possible from the samples obtained in the wells now drilling. However, if the productive area of the deep pay is equal to that of the shallow pay, there will be about 3100 acres, two-thirds of which will be owned by the Big Lake Oil Company.

Deep Possibilities in Other Fields in West Texas

The Big Lake field shows a closure on top of the lime of 150 feet within the producing area. This compares with 350 feet for the Yates pool, 150 feet for the McCamey field, 300 feet for the Church and Fields-Gulf-McElroy pool, 250 to 300 feet for the Howard Glasscock field and 450 feet for the Hendricks pool in Winkler County. The question arises as to whether or not the deep formations encountered in Big Lake actually extend as far as the above-mentioned fields. The Shell Petroleum Corporation drilled a deep test on the highest point structurally of what is known as the Fort Stockton high. This well was located about 20 miles west of Fort Stockton, near the Orient Railway tracks. Granite was encountered at about 5500 feet, which disproved the theory that the Big Lake pay extended as far west as this well. The Yates pool, Taylor Link pool, Masterson pool and the Pecos Valley pool in Pecos County all lie along or near this Fort Stockton high. The Penn pool, O'Brien pool in Ward County and the Hendricks pool in Winkler County lie along the northward extension of the Fort Stockton high.

Other West Texas fields will no doubt receive a deep test in the near future and results of drilling in the Big Lake field should be of some aid in planning a drilling program for these potential fields.

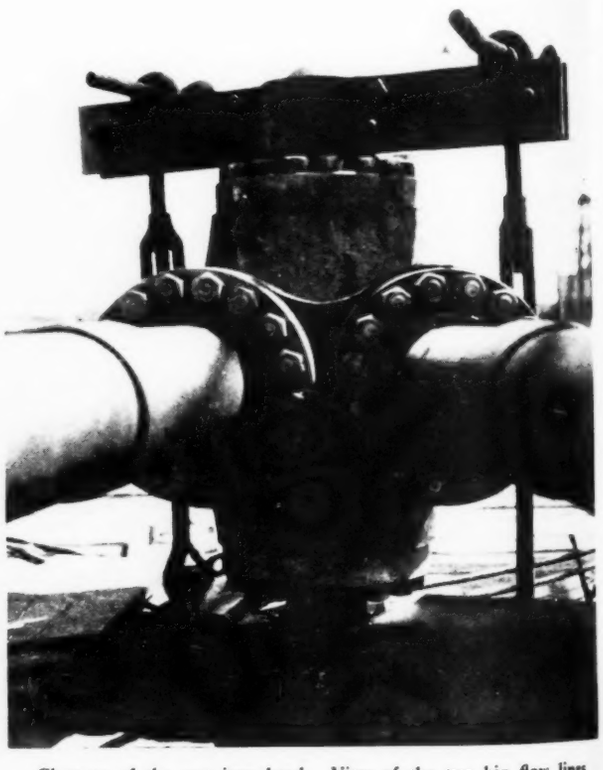
Unique Connection on Flowing Well

THE difficulty experienced in the Oklahoma City field from sand cutting out the connections has resulted in several changes in the usual Christmas tree connections on the producing wells in that field.

An unusual and very interesting connection for a flowing well is to be found on the Skelly Oil Company's Hoopes No. 3, in the southern part of the field, where sand is especially hard on connections. V. L. Reed, division superintendent for the Skelly company, has installed a cast iron head or cap.

Flow lines connecting two separators. One line enters from the back side by the same connections as the line in the foreground.

The connection has no flow valves on the derrick floor. Two large flow lines run at different angles from the iron head to two separators. All gates for shutting the well in during periods of proration are in the cellar.



Close-up of the cast iron head. View of the two big flow lines going into the head.

The walls of the cast iron head are three inches thick. The head has an outside diameter of 24 inches and an inside diameter of 18 inches. The total weight is one ton. The head is flanged at the bottom to 6⅝-inch casing and at the top to 7-inch casing.

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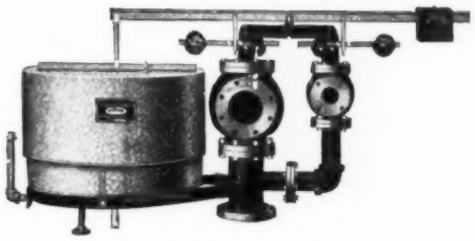

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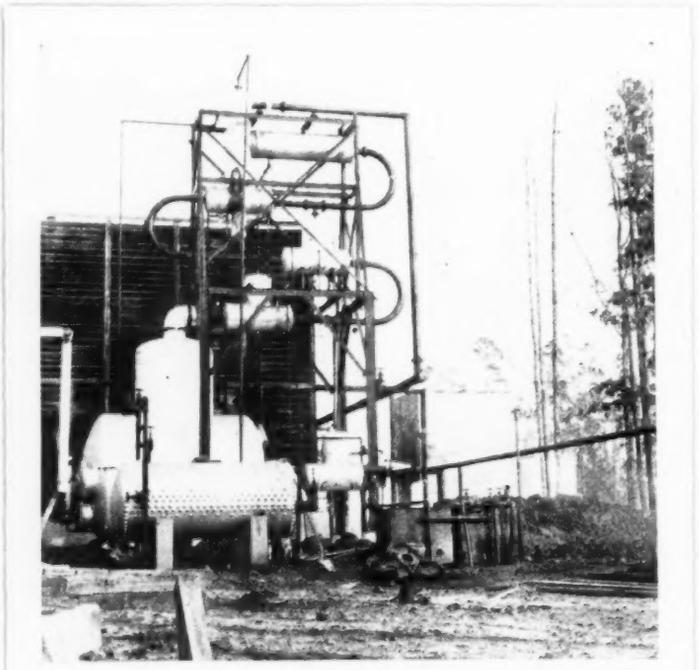
Determining Gasoline Content *of* NATURAL GAS

By H. L. KAUFFMAN *

BEFORE designing a natural-gasoline plant it is essential that one know how much gasoline is contained in the gas as it comes from the well. The natural-gasoline content of a gas is defined as the hydrocarbon condensate derived from natural gas which is composed of the total percentages of pentane plus higher-boiling hydrocarbons occurring as vapors in the natural gas, plus a sufficient percentage of normal butane to cause the total condensate to possess a saturation pressure (P) at a temperature (t).

The oil-absorption or charcoal-absorption methods are commonly used for ascertaining the yield of gasoline from a particular gas. However, these methods may not be entirely accurate.

For the foregoing reasons it is therefore believed that readers of this publication will be interested in knowing that the Bureau of Standards has recently developed a method and apparatus designed and assembled for accurately determining the gasoline content of natural gas. The course of procedure and apparatus are fully described by Shepherd in a paper published in the June (1929) issue of the Bureau of Standards' Journal of Research (pages 1145 - 1199). In this article there are described and pictured a complete testing unit, a simplified unit for commercial laboratories, and an experimental unit, while also reproduced and discussed therein are fractionation charts giving a condensed record of the treatment of various samples of natural gas.



Natural gasoline still at one of the Palmer Corporation plants in Louisiana.

The apparatus comprises means of measuring gas and liquid volumes, absorption and, if desired, combustion pipettes, pumps for the transfer of gas, and a system of distilling bulbs, which latter are connected by fused glass joints only. There are also provided means of controlling and measuring low temperatures, liquid air containers and one or more vacuum pumps.

In making the test the natural gas is separated into:

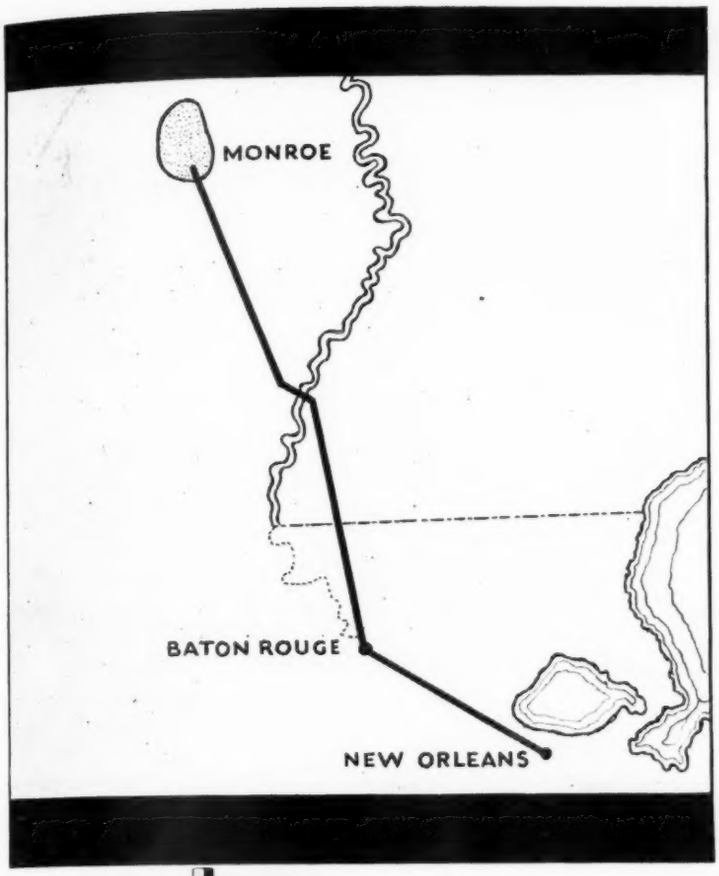
1. Isobutane, propane and the lower hydrocarbons, together with the nitrogen, oxygen, carbon dioxide and helium, if any.
2. Normal butane.
3. Pentane and higher boiling hydrocarbons.

The first two are measured as vapors. The third is obtained by difference and is checked by measuring in the liquid phase. After determining the vapor pressure of the pentane and higher boiling hydrocarbons, measured increments of the butane fraction may be added to it. No isobutane, propane or lower boiling hydrocarbons are included in the "natural gasoline" yield.

The following description of this new method for testing natural gas for gasoline content was abstracted from the original article by the librarian of the Universal Oil Products Company, and was published in this company's Library Bulletin, Vol. 4, No. 29:

After the apparatus has been evacuated a ½-liter sample of the gas is introduced into a buret and measured. It is transferred to the first tube of the distillation chain and separated into three fractions by isothermal fractional distillation at low temperatures. The first fraction consists of isobutane and lower-boiling fractions, the second of normal butane alone, the third — the "pentane fraction"—of pentane and higher fractions. Most of the nitrogen and oxygen, with any rare gases present, are first pumped off after cooling the sample in liquid air and to a temperature of —210° C. The remaining nitrogen is distilled off, together with the methane and most of the ethane. This simplifies the work of separating the propane and isobutane fractions. A rectifying tube, which forms a part of the apparatus, is an important time-saver. The process of separating the hydrocarbons remaining consists in holding the sample, in the first distilling tube of the series, at a temperature at which the component to be distilled off has an appreciable vapor pressure and at which the next higher boiling component exerts a negligible vapor pressure. The next tube is in a bath maintained at a temperature low enough to render negligible the vapor pressure of the component to be distilled over. The distillate passes from one tube to the other through a stopcock. To effect better separation the condensed distillate is partly vaporized again and recondensed at the temperature selected for the next distillation. The condensate is put back into the first tube, the distillate is placed in the following one. A second distillation is made and the distillate is put forward, the residue back. When the pressure in the connected distilling and condensing tubes drops to the saturation pressure of the low-boiling component in the pure state or below, the completion of the distillation is indicated.

* Consulting Mechanical Engineer.



18-inch 500-lb. W. P.—1000-lb. test

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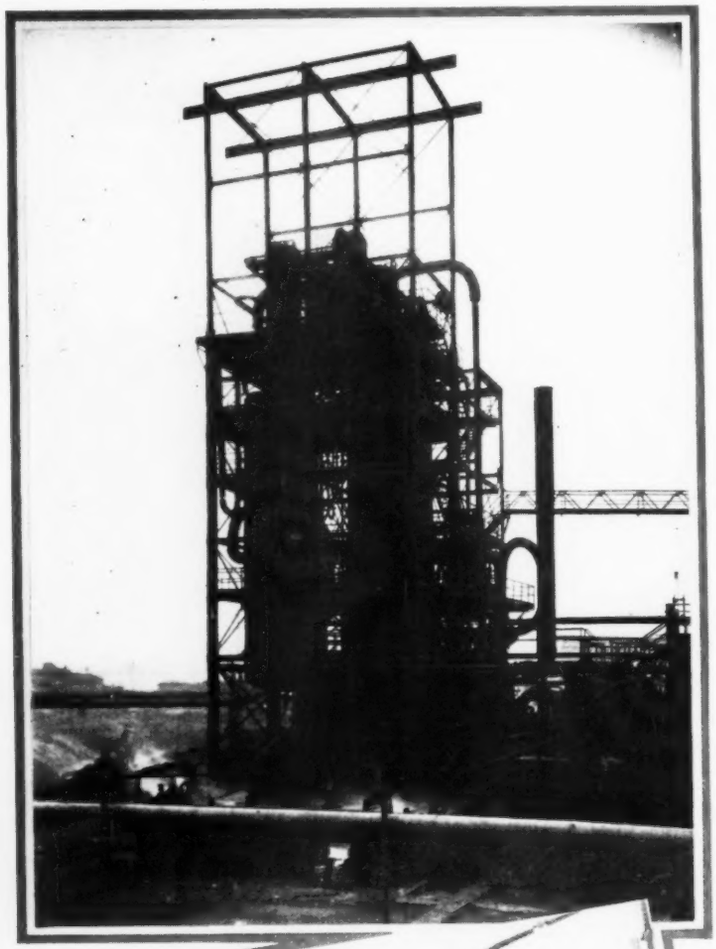
Air Heaters Used for

Increasing Cracking Furnace Efficiency

IN THE modern cracking unit the tube still or oil heater is a very important feature, as it must heat the oil up to the cracking temperature very uniformly in order to minimize coke and fixed gases. The satisfactory heating of the oil must also be carried on as economically as possible, and consequently a high thermal efficiency is important. The tube still of a cracking unit should be so designed that the oil is never overheated at any one point in order to prevent coke formation on the tube walls. A high rate of flow is required and sufficient surface for the absorption of radiant heat from the furnace so that low temperature furnace gases enter the convection section.

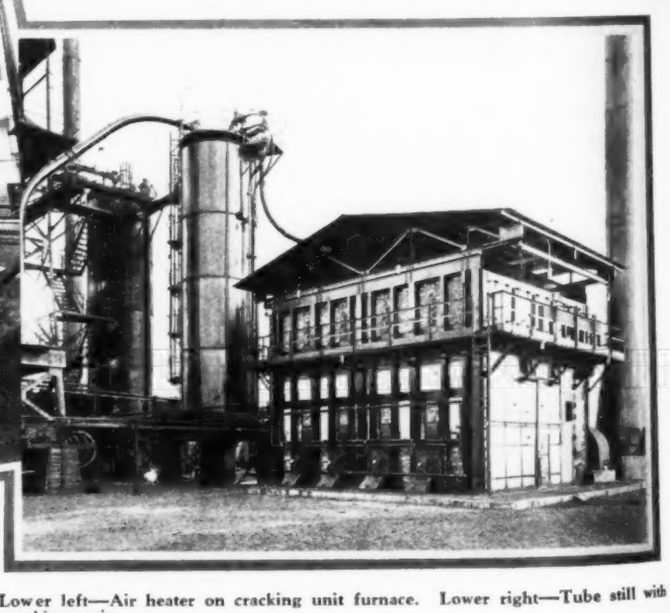


A high thermal efficiency is obtained by maintaining a high gas velocity over the convection tube bank and firing with a minimum excess of air. In this way the flue gas temperature can be held within 200° F. of the entering oil temperature without recirculation.

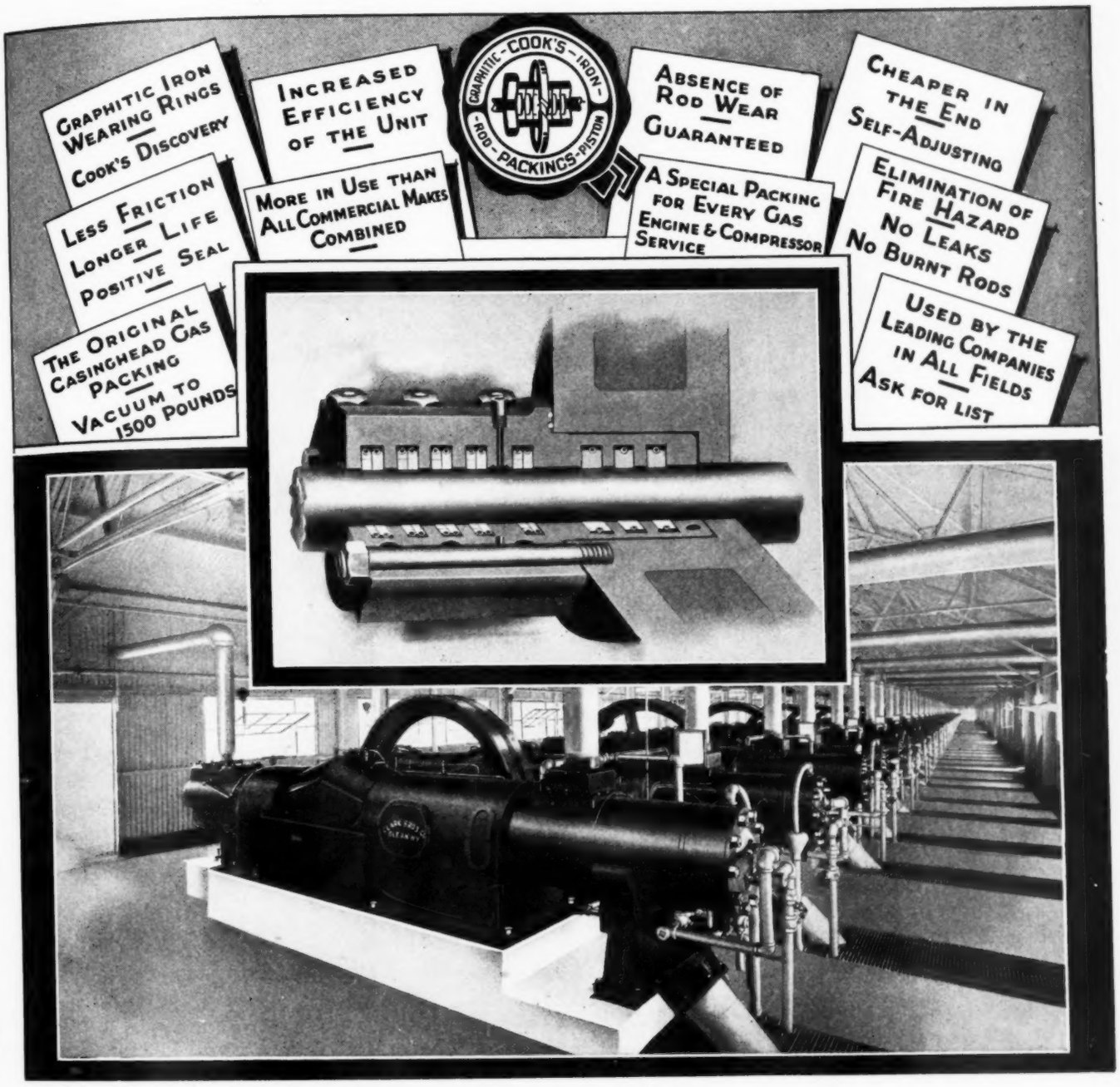
When the temperature of the oil entering the still is high the flue gas temperatures are high also, and the use of air heaters reduces the flue gas temperature. It is possible to cool the flue gases to 400° F., even though the entering oil temperature is above 600° F. and thus a high thermal efficiency, above 80 per cent, is possible.

A cracking unit, having a throughput of 7,200 barrels per day, is operated at a very high thermal efficiency by means of an air heater. The inlet temperature is 735° F. and the outlet temperature 940° F. The air heater shown in the photograph (below, left) cools the flue gases from 900° to 625° F., while the air for combustion is heated from 150° to 490° F.

This air heater is a three-section installation and contains 2,360 square feet. This photograph shows the installation with ducts, fans and stack. This type of air heater is used both on Dubbs and Cross cracking units with great success.



Top—Tube and tank cracking units at Standard Oil Co. of Ohio plant. Lower left—Air heater on cracking unit furnace. Lower right—Tube still with Dubbs cracking unit.



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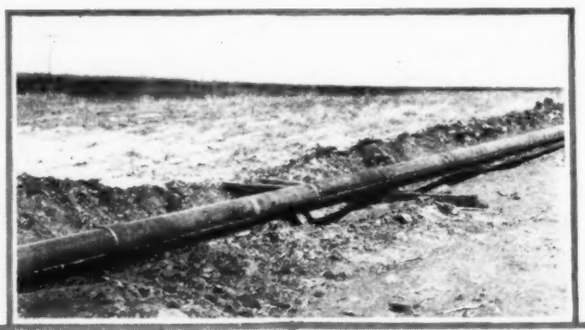
Welding plays Important part in

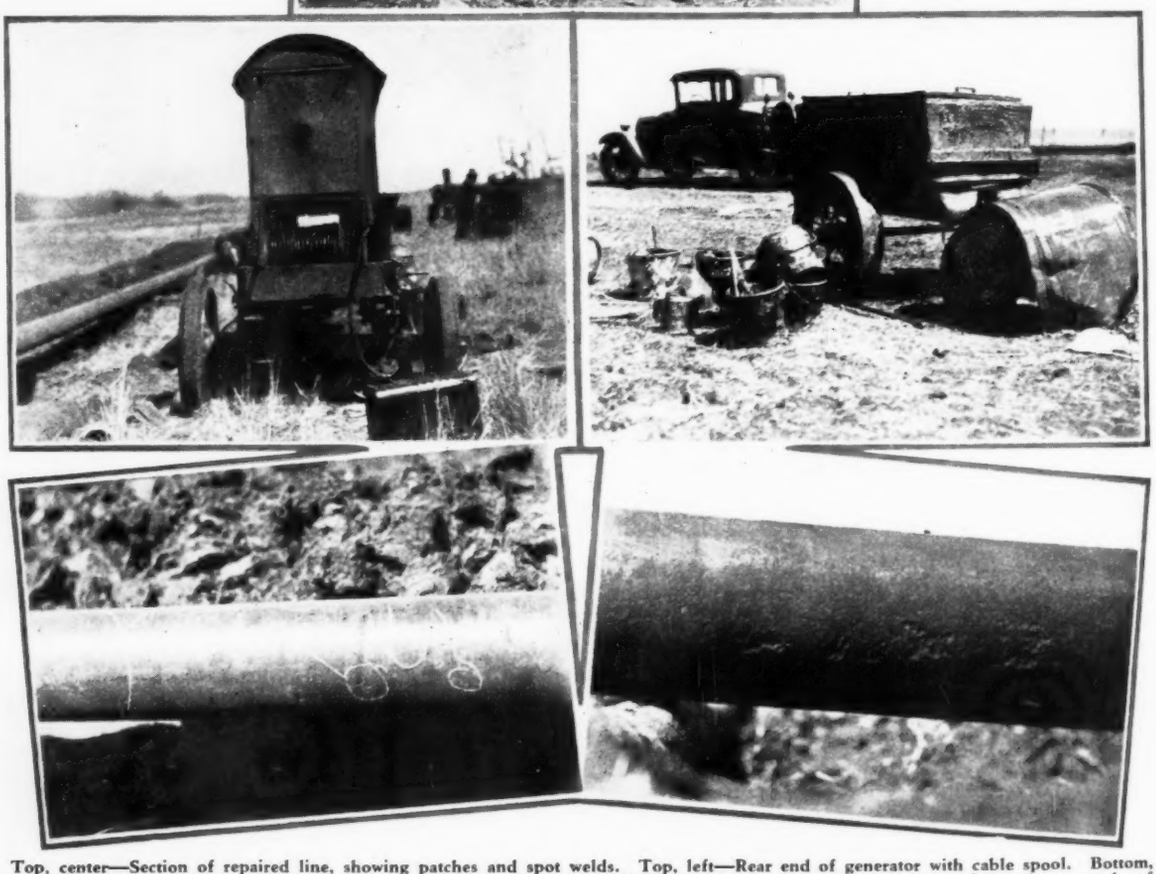
Reducing Pipe Line Reconditioning Costs

RECONDITIONING pipe in an oil line to extend the life of the carrier has in many cases proven a costly piece of maintenance work, not only from a standpoint of labor cost but from the loss of service at intervals when it was necessary to cut out a section of the line and replace it with new pipe. The research departments are giving considerable thought to this phase of maintenance, because several old lines in the country are reaching that point of service where they will either have to be reconditioned or replaced. The Empire Pipe Line Co. started reconditioning an 8-inch line running from Cushing, Okla., to Eldorado, Kan., two years ago. At that time a section of the line could be cut out without seriously interrupting service to the refineries. Since the work started the line became a more important carrier when it was tied in to handle part of the production from the Oklahoma City field. It was necessary to use all available capacity and consequently it was necessary for the repair crews to devise means of reconditioning a loaded line without cutting out a section.

T. J. Lanagan, Dist. Supt. Empire Pipe Line, Cushing, Okla.

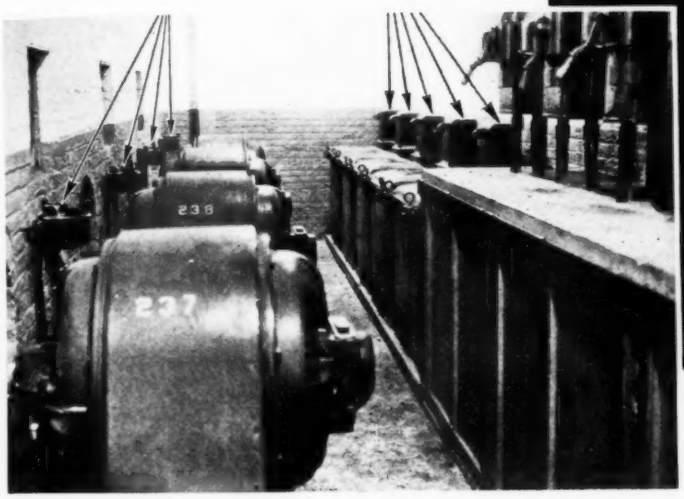
As a result the Empire company's reconditioning crew has devised a method of patching an entire joint of loaded pipe, devised a unique collar sleeve and in general the reconditioning jobs are proving grounds for new ideas that may speed up or improve the type of work. The line was built in 1917 and standard lapweld 29-pound screw pipe was used. Part of the line was laid by machine and the only protection against corrosion was a thin, cold application of paint. Most of the flange unions and some of the collars were replaced a few years ago by welding. The type of corrosion is more of a localized condition characterized by deep pitting from an eighth of an inch to an inch in diameter in individual pits. These vary in location from as few as one or two per joint to a group so closely related that the pits overlap and cover large areas of the pipe. Corrosion is found principally on the bottom and sides and poorly drained soil showed a greater amount of corrosion than well drained soil. Corrosion around collars, in many instances, is pronounced. This was found around collars that showed evidence of having





Top, center—Section of repaired line, showing patches and spot welds. Top, left—Rear end of generator with cable spool. Bottom, left—Method of marking pits in pipe for spot welding. Top, right—Field pots for heating paint. Bottom, right—An example of pits found in the pipe.

Flameproof because oil-immersed —*EC&M 2300 Volt Motor Starters*



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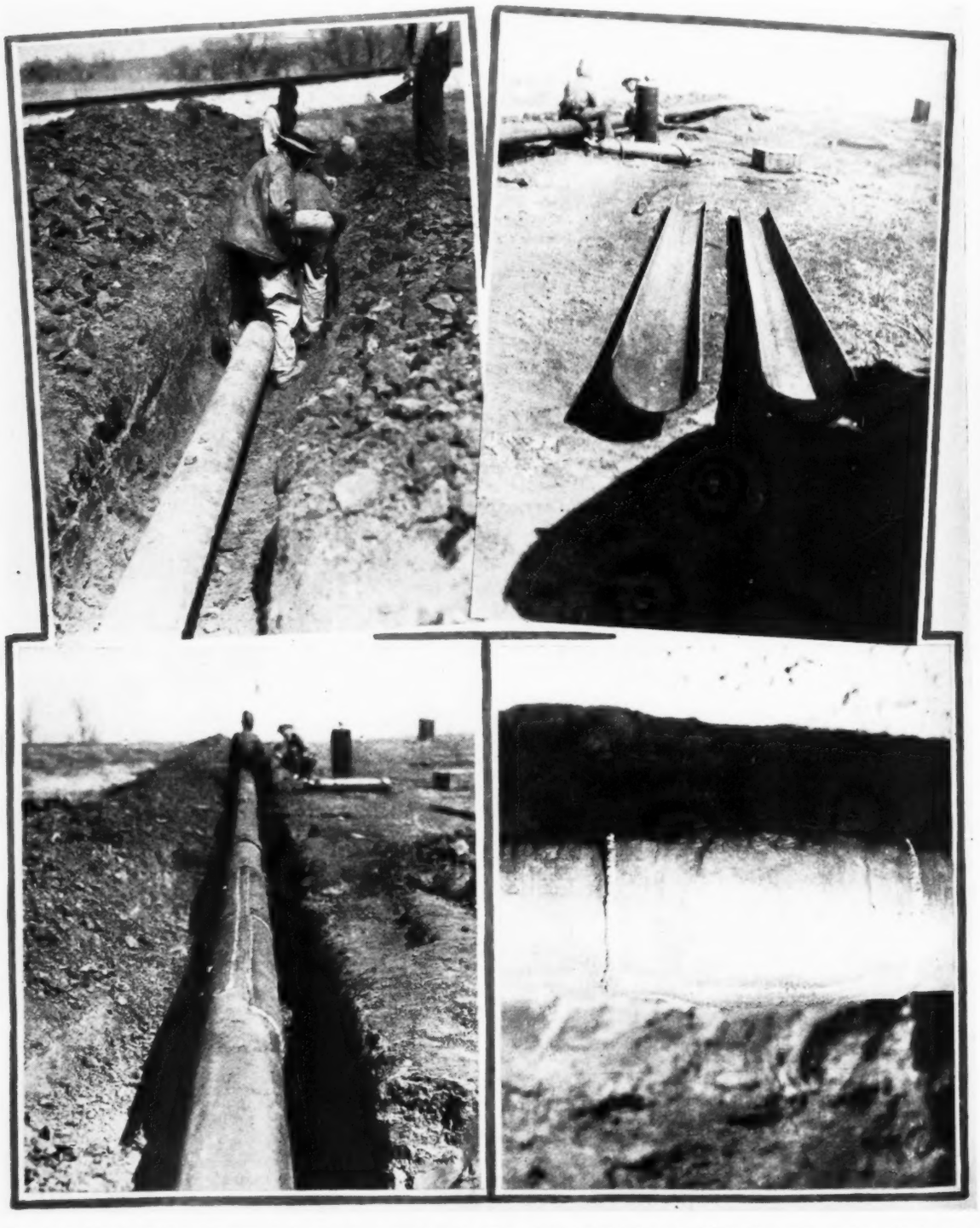
leaked in the past. In well-drained areas some joints of the pipe appeared to be in as good condition as the day it was buried and the mill marks on the pipe are plainly visible.

The crew doing this work for the Empire is what may be termed as expert in this particular line of work. All of the pit holes are spot-welded by arc welders who were selected as among the best for this type of work. Virtually every man on the crew has considerable experience in reconditioning.

When it was necessary to cut out the line on the first part of this work it was merely a matter of displacing the oil with water. When a section was ready to be cut out, an amount of water—a little more than necessary to fill the gap to be cut out, was pumped in. Gates were set in and this procedure was followed throughout with the minimum loss of oil.

Starting with the order of events in reconditioning on this line, a ditcher was used to uncover the pipe wherever the right-of-way permitted. The ditcher opened a trench two feet wide and as close to the pipe as possible without striking. The ditching machine operator was helped in this work by a helper following immediately behind the ditcher boom with an iron prod. By using the prod the helper could easily tell when the machine was ditching too



Top, left—Hand ditching. Bottom, left—Detail of patch weld. Top, right—Split joint of 10-inch pipe ready to be welded over a loaded joint of 8-inch. Bottom, right—Collar sleeve welded over faulty coupling.

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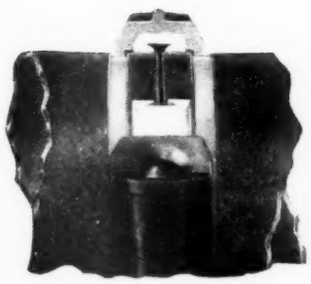

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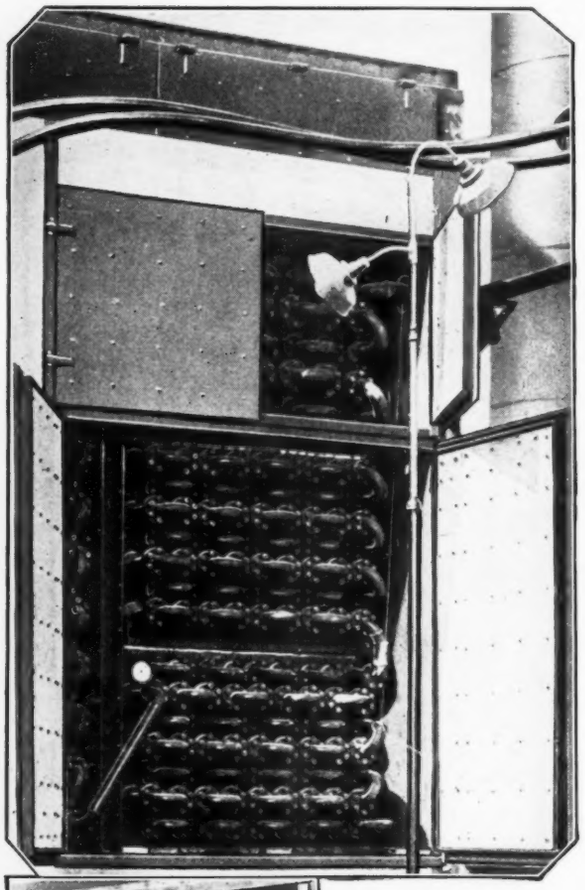

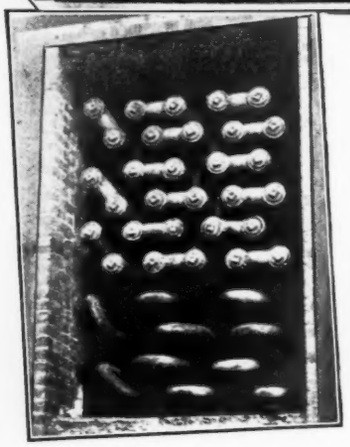

Above: After two years of actual experience, Southwestern Engineering Corporation now uses Tube-Turns as *standard equipment* in their Southwestern Tube Stills.

Below: Tube-Turns are replacing cast fittings as fast as the latter wear out in this retort operated by a large California oil company.

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The Stock Fittings for Pipe Welding

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close to the pipe. Guide lines were stretched to guide the ditching machine operator. Men with shovels followed the machine and stripped the pipe to the bottom.

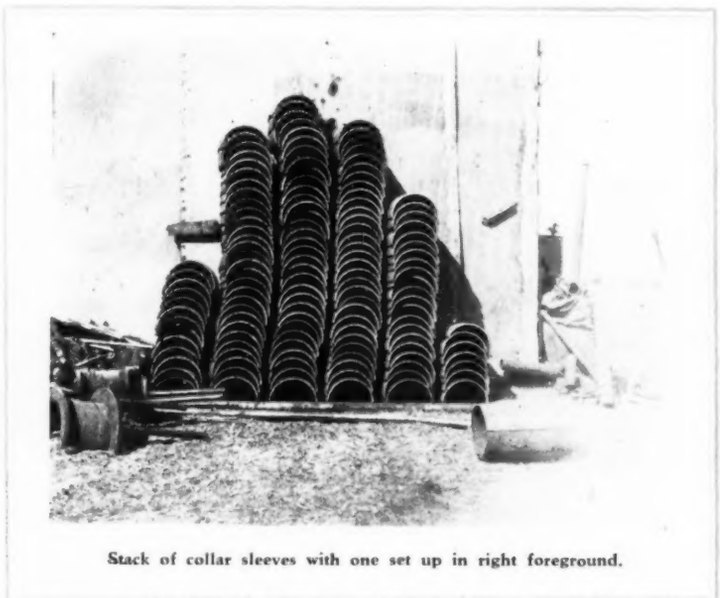
After the pipe was stripped, portable tripods were used to raise it from the ditch. These tripods are mounted on wheels and have a winch, cable, clutch and brakes. A traveling pipe-cleaning machine is used to knock off all of the scale and dirt to get the pipe ready for inspection. In order to conserve time, raising and cleaning is usually a continuous operation. The line is held on tripods as the machine advances, and as the machine approaches a tripod a skid is placed under the pipe behind the machine and the tripod moved on ahead of the next one. This permits a more or less continuous operation of the cleaning machine, as the tripods are continuously moved on ahead of one another. One run over the pipe usually cleans the metal satisfactorily except the pits. However, in some sections it is necessary to run the same machine over the pipe twice. With the pipe ready for inspection an inspector goes over each joint, carefully hammering it and spotting all of the pit holes. As these are spotted he marks the pits with chalk, as shown in the accompanying photograph. Small pits are not marked, because if they are not deep it is believed the protective coating to be later applied will be sufficient protection against further attacks on the pipe at this point for a reasonable length of time.

R. G. Taylor, Empire Pipe Line Co.

Arc welding is used throughout in all of the reconditioning welding. The portable machines are spotted with teams and one spotting will permit a welder to work 500 feet of pipe. The machines are equipped with spools containing 250 feet of cable, permitting the operator to work 250 feet in each direction.

If a pit exceeds more than half of the wall thickness of the pipe and over half an inch in diameter it is not considered safe to weld if the line is loaded. On the pits that can be welded while the line is loaded the welder makes a spot-weld flush with the walls of the pipe. Each pit hole is cleaned with a wire brush before the repair is made and only a good grade of rod is used. It is not considered necessary to make any particular effort toward cleaning the pits. The arc knocks the deposit instantly and the material seems to act in the nature of a flux. A number of specimens have been cut through with a hacksaw and the bond was satisfactory.

When it is considered a joint is too badly pitted to be spot-welded or the pits are too deep to permit safe spot-welding, patches are used. The late R. A. Nelson brought out the idea of patching a loaded line. On this particular job 8-inch pipe was used for patching. The pipe was cut in two with a cutting torch and then beat out so it would fit snugly over the 8-inch line. This method worked very satisfactorily where the patches were not over five feet long.



Stack of collar sleeves with one set up in right foreground.

At this particular stage of the work several joints were found that ordinarily would have been cut out of the line. However, it was not desirable to cut out any section of the line and these joints were to be patched the best as possible under the circumstances and buried. Dick Nelson, one of the welders, conceived the idea of splitting a joint of 10-inch pipe with torches and welding that over the entire surface of the 8-inch pipe. When the 10-inch is cut the metal burned away leaves approximately enough of the 10-inch to fit snugly over the 8-inch. In this manner many bad joints that would have been cut out and relegated to the junk pile have been saved. All of the patching pipe is used pipe and therefore not too expensive to use. Another method used which is comparatively new and developed on this job is the collar sleeve which is welded over a leaky joint. Most bad joints that were leaking were made safe by calking before the sleeve was welded on. This sleeve was designed by R. C. Taylor, who is supervising the reconditioning work. It eliminates cutting out the line to repair a bad coupling and is, of course, more economical and speedy. The first work along this line was done when a short piece of 10-inch pipe was cut from a joint with a torch and halved. Pie slices were cut in the ends and then the ends were hammered together and welded. By cutting pie slices in the ends and then beating the pipe together the ends of the sleeve would fit snugly around the 8-inch while the middle section of the sleeve fitted over the collar. Later on these sleeves were manufactured in a Mid-Continent shop. To make sure the sleeves would hold up over a faulty collar, a test was made.

In welding a sleeve on the two halves are clamped on with one longitudinal seam on top. After this seam is welded the sleeve is turned over, making it possible to weld the other longitudinal seam from the top. The ends are then welded to the pipe in the manner that pipe is usually joined. Welding patches or a full length of 10-inch pipe over 8-inch is done by placing the pipe so the longitudinal seams are on the sides. On some of the collars that showed evidence of leaking, rope welds were made around the ends of the collars to further strengthen the coupling. The average pit hole weld required about 15 seconds. On one of the joints there were 54 pits to be welded which were filled in about 15 minutes with almost four lengths of $\frac{3}{16}$-inch rod.

Following the completion of all of the repair work, the line is given a priming coat by pouring paint on top and spreading it with a priming rag. After the primer has died a hot application is put on in a similar manner. The latter application is heated in the field in heavy field pots, using pressure burners to heat the coating to around 400 degrees. The company maintains its camp and the average number of men attached to the crew is 50. The company supplies tents, cots and other camp equipment.

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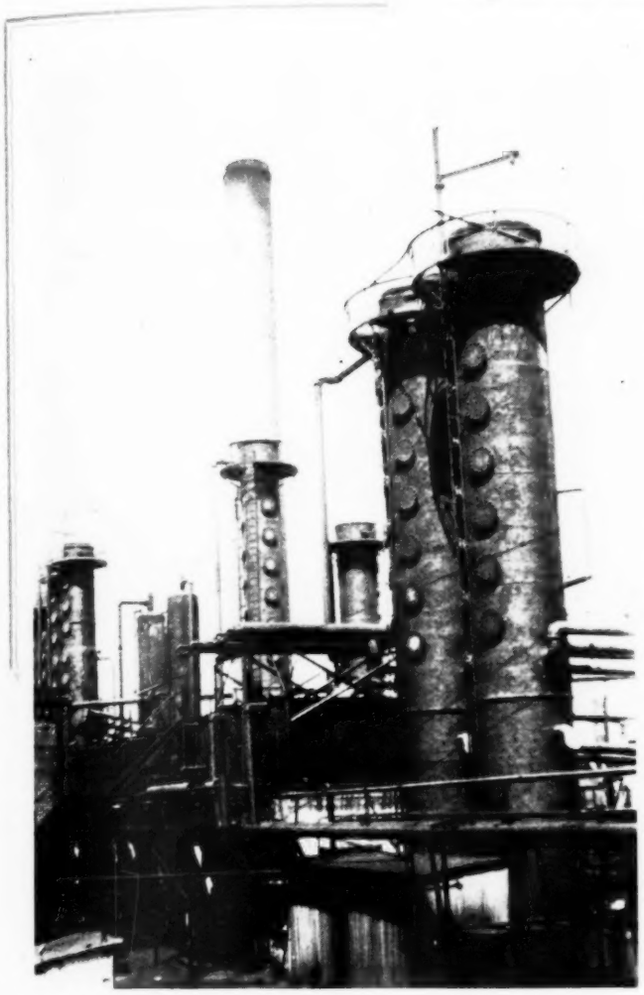
Determination *of* Lube Oil Pour Point

By MAXCINE J. JAPOUR
Chief Chemist, Champlin Refining Co.



Fractionating towers, Champlin Refining Co., Enid, Okla.

THE present-day industry demands lubricating oil that will flow at zero or subzero temperatures. The tendency today is for paraffine base oil refiners to completely remove the wax from the oil so that it will flow at the temperatures mentioned above. The question now is whether the complete removal of wax will give zero cold tests on bright stocks, particularly on oils that have a viscosity of 150 at 210 degrees F. or heavier. Before going into this discussion it might be well to state the United States Government Specification, Technical Paper 323B, methods 20.12 and A. S. T. M. method D97-28, concerning the cold test, which constitutes cloud and pour points.

I. (a) The cloud point of a petroleum oil is that temperature at which paraffine wax or other solid substances begin to crystallize out or separate from solution when the oil is chilled under certain definite specified conditions.

(b) The pour point of a petroleum oil is the lowest temperature at which this oil will pour or flow when it is chilled without disturbance under certain definite specified conditions.

It can be seen that the cold test is synonymous with wax removal. In other words, the public has adopted the cold test as a qualitative determination for wax. Under the new method of dewaxation, where a complete removal of wax to a point where the cloud is not even visible at a temperature as low as 25 degrees below zero or more and the congealing point of the oil is slightly higher than zero, there is but one conclusion to arrive at: The pour point of the oil depends upon the viscosity of the oil rather than on the percentage of wax, when the oil shows no cloud point.

Before going any further it might be well for us to review what the test is significant of and why thought reverts back to the wax content when a mention of cold test is made. The definition of cold test as given by Holde and Meuller (Hydrocarbon Oils and Saponifiable Fats and Waxes) is the solidification phenomena of oils. This, according to Allen (Commercial Organic Analysis) is due to petroleum jelly, soft paraffine or to solid paraffine.

Petrolatum, or soft paraffine, which consists chiefly of isoforms of methane, $C_{16}H_{34}$ to $2C_{20}H_{42}$, contains those portions of petroleum which are soft or pasty at ordinary temperature and, in combination with mineral lubricating oil, is thinned out or rendered semi-solid. This product is a poor lubricant at operating temperatures of motors and, due to its congealing qualities, retards the fluidity of the lubricating oil at lower temperatures. Consequently, its removal plays a very important part as to the nature of fluidity of the lubricating oil and the cold test is an indication of its presence. It was found also that the larger the amount present, the higher the cold test would be. The wax, or solid paraffine, above its solidification point, or in combination with a mineral thinner, remains fluid. It was found also that it becomes plastic or solid at lower temperatures and thus we find great hindrance to fluidities of oils, depending upon the percentage of paraffine present. These waxes are of two different natures. From the light lubricating oils, or those oils called neutrals, paraffine is obtained, while the heavier oils contain petrolatum or soft wax. These waxes, in addition to having a detrimental effect at low temperatures, have poor lubricating qualities at higher temperatures.

Continuous treating plant at Champlin refinery.

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Simplifying Crude Oil Treating Problems *in* Oklahoma City Field

By LEE TALBOT[1]

A SURVEY of the oil treating situation in the Oklahoma City field, indicates that quite a variation of ideas exist as to how it should be handled. As the Oklahoma City field offers an entirely different situation from that found heretofore in the Mid-Continent, it will have to be handled just a little bit differently, and provisions must be made to alter treating conditions accordingly.

It appears that some of the companies are installing plants that will procure temporary results, without looking to the future. These will have to be altered sooner or later, as treating problems have just started. The difference between a good treating system and a temporary treating system, will mean about six cents a barrel gained or lost. Some reports on these temporary treating plants show an excessive use of chemical and heat which means a loss of gravity. For instance, one company is treating oil at an expense of one cent a barrel chemical cost, but due to the construction of their plant they receive in the stock tanks an off-color oil, which means a loss in A. P. I. gravity of one and one-half to two degrees. When this is taken into consideration, it will be found far cheaper to build a good treating plant than to install a temporary plant and assume the loss.

Figure 1 shows a treating unit for one well, capable of handling 10,000 barrels a day. Taking the first two lines leading from the traps into a 15½-inch equalizing conductor, this should be made the same height as the tank. At the top of the conductor, some baffles are welded in crosswise that will eliminate any oil going over and yet allow the gas to escape. From this 15½-inch conductor is a discharge into the conductor at the base of the tank through an 8-inch nipple. The conductor at the base of the tank is made of 12½-inch pipe, which allows a continuous expansion of fluid from the time it enters the upright conductor until it is distributed in the treating tank. This is used for the purpose of slowing down the speed of the fluid, making a continuous flow in the tank and doing away with the rolling of the fluid that otherwise might occur. The distributing conductor is made of 12½-inch casing with one end welded, the other end swedged, and an 8-inch nipple is welded to make flange connections at the tank. Two collars are welded on each side at the middle of the first joint, in order to provide for cross distributors and also to eliminate trouble in installing in the tank. This conductor has eight distributing ports four inches wide and 12 inches long well spaced in order to give equal distribution of the oil.

The platform for the coils is made of four by four timbers three and one-half feet high. These should be well made and anchored to the base of the tank. The coils should be made of four-inch pipe and a swing should be installed in the intake and the discharge ends of the coil, to allow for expansion and contraction, and eliminate leaks arising from such causes later on.

The platform for the distributors is made of four by four timbers laid on coils two feet apart and anchored to the coils. In order to get 100 per cent sheet distribution, it is advisable to use either two by two timbers or three by three laid side by side, allowing three-quarters of an inch space between. This will allow about three-eighths inch for expansion of the wood after it has become water soaked.

The thermometer can be placed at various places. It is sometimes installed at the top of the water level, and sometimes at the oil discharge level, but it makes very little difference as the temperature of the oil can be judged very easily as long as the thermometer is placed on the tank. The water level on the first tank should be carried about two-thirds of the way up, insuring the oil a good water wash.

The settling tank does not differ from the first with the exception of the water level, which is lower to allow more

[1] Consulting Petroleum Engineer.

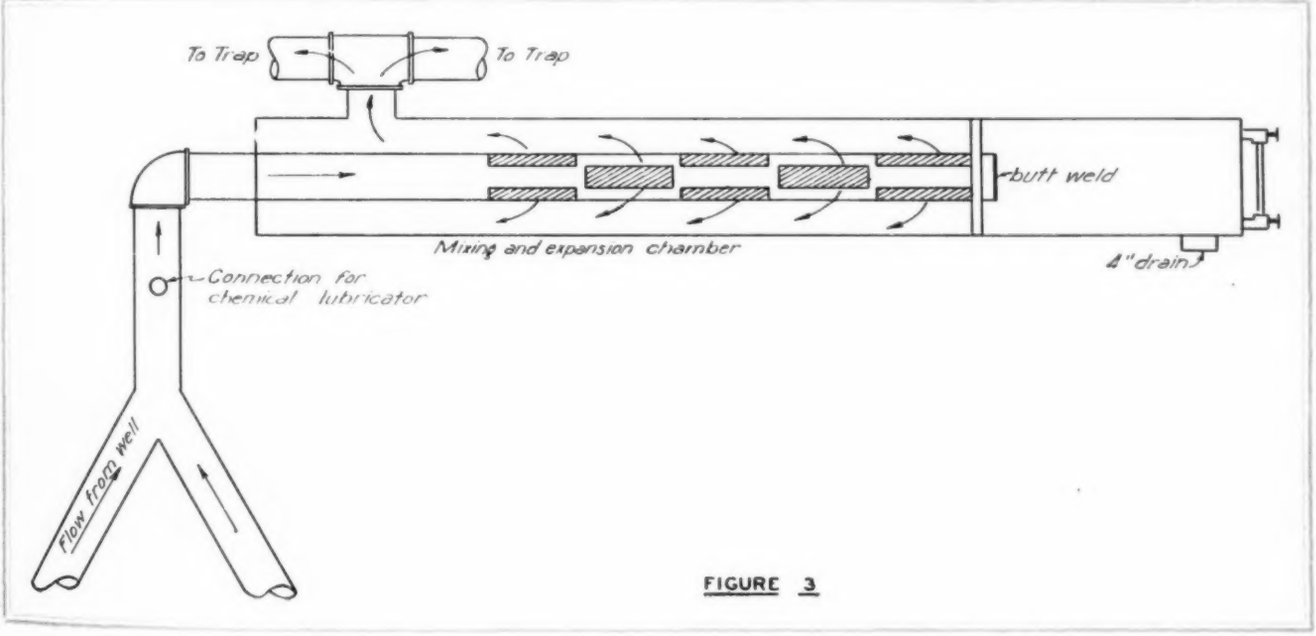

FIGURE 3

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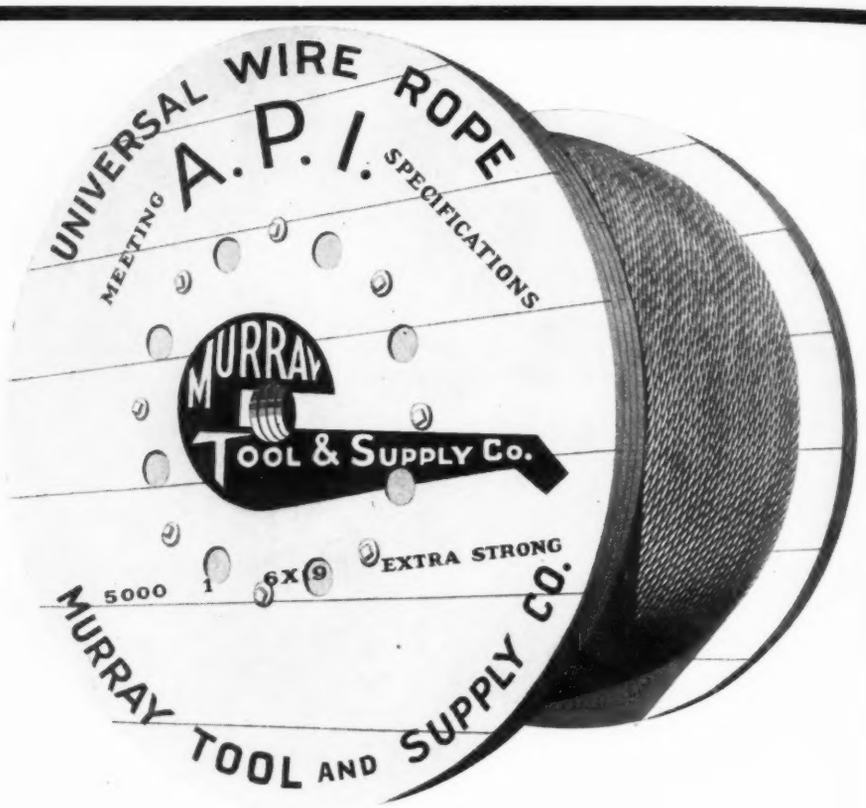

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settling space for the oil. For the discharge oil lines, it must be taken into consideration that some of the wells flow by heads and enough room must be left in the tank to allow accumulation of oil due to the onrush of the flow from the wells. Therefore, the discharge connection should be in the middle of the top ring of the tank. There should be an overhead gas line connecting the upright conductor and the treating tanks, and discharging into the stock tank. In this manner all gas is taken off and condensed to gasoline, which is a great aid in keeping up the gravity of the oil and making this treating system gas-tight.

Figure 2 shows a 40-acre hook-up with a capacity of 25,000 barrels. As the production of all wells is prorated, and probably will continue to be for some time, this system should be quite a saving to any company operating on a large scale. It does away with the individual well-treating unit which is commonly installed in the field. It systematizes the flowing of the wells, besides cutting down material, labor and treating expenses. It is composed of three tanks, a 500-barrel flow tank and two 1,600-barrel

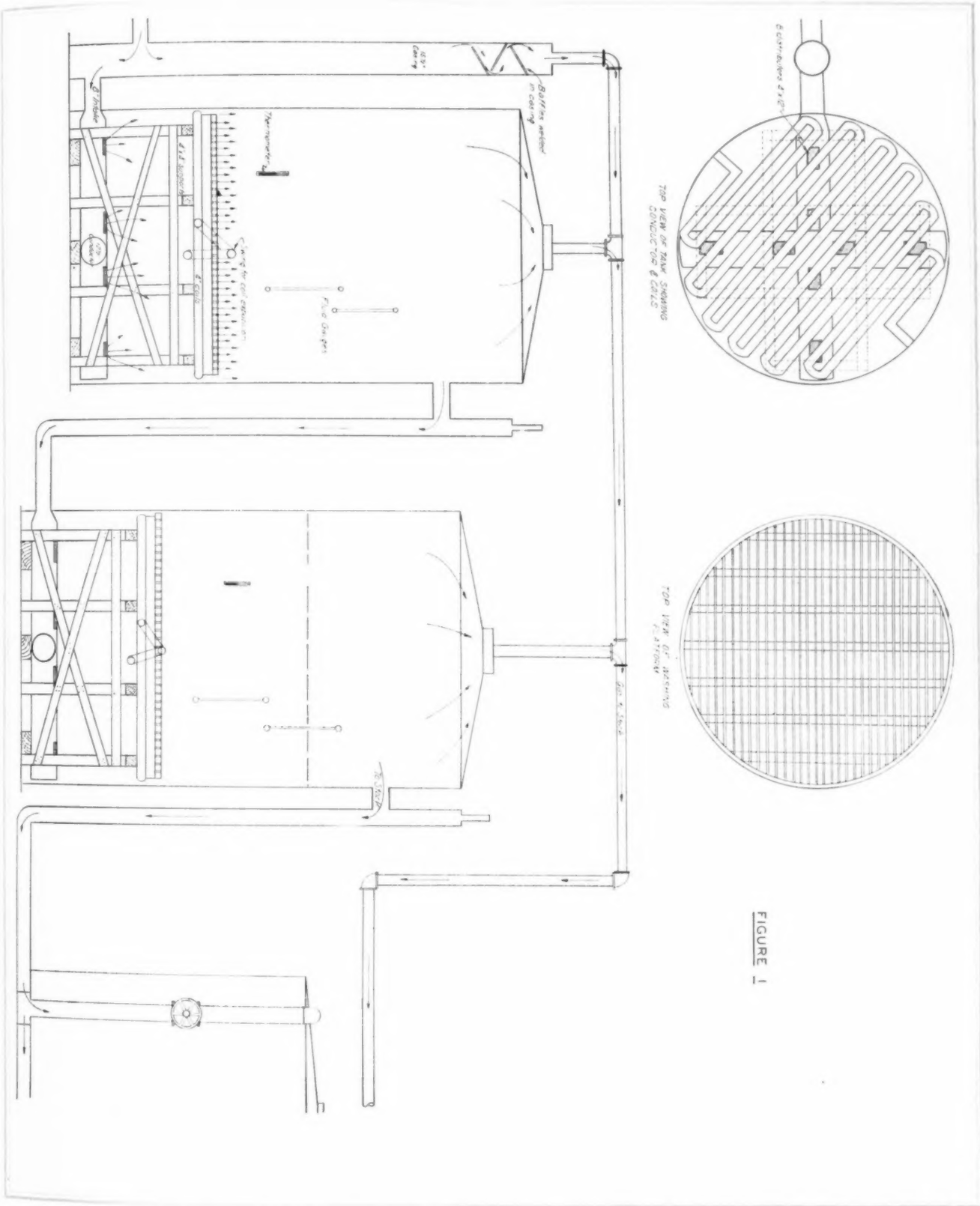

FIGURE 1

treating tanks. The 500-barrel tank will serve several purposes. It is large enough to allow two wells to flow in at one time, and also will allow the taking care of excess water later on. Provision is also made for the gasoline department to take off gas if it is desired to do so later on. The treating tanks in this system are the same as those in Figure 1.

Figure 3 shows a mixing and expansion chamber that is placed between the well and the trap. It is made of 15½-inch casing 30 feet long with a 6⅝-inch perforated 20-foot joint welded in from one end. This acts as a thorough chemical mixer, as well as the first expanding point on the system. It also serves as a sand collector and as a water trap that can be utilized to great advantage. This should be installed so that the lower end will be about a foot lower than the discharge, in order to take care of accumulation of water and sand. The discharge should be 6⅝-inch from there branched off to the two traps. This will certainly cut down the chemical cost, as it will give a thorough mixture and allow more time for the water to settle out.

A three-trap system is also employed in this hook-up in case it is desired to take off all gas from the lease.

Figure 4 shows the complete installation of the three tanks. The natural topography of the Oklahoma City pool seems to be in favor of the operator for the proper installation of treating systems, as it is almost perfect for gravity system installation. There is but one thing to be taken into consideration in installing this system, and that is to allow enough drop in fluid level from tank to tank to eliminate the overflowing of tanks by an onrush of fluid from wells flowing by heads. It would be advisable, therefore, to allow at least four feet difference in fluid level from tank to tank in the treating system.

While the initial expense of these treating systems may seem rather large when figured out, and slightly more expensive than many of the present installations, they should prove far more efficient as they will mean the difference between treating crude oil at six cents a barrel and at .0042 cents a barrel. One operator shows the latter figure over a period of treating oil in the Oklahoma City field.

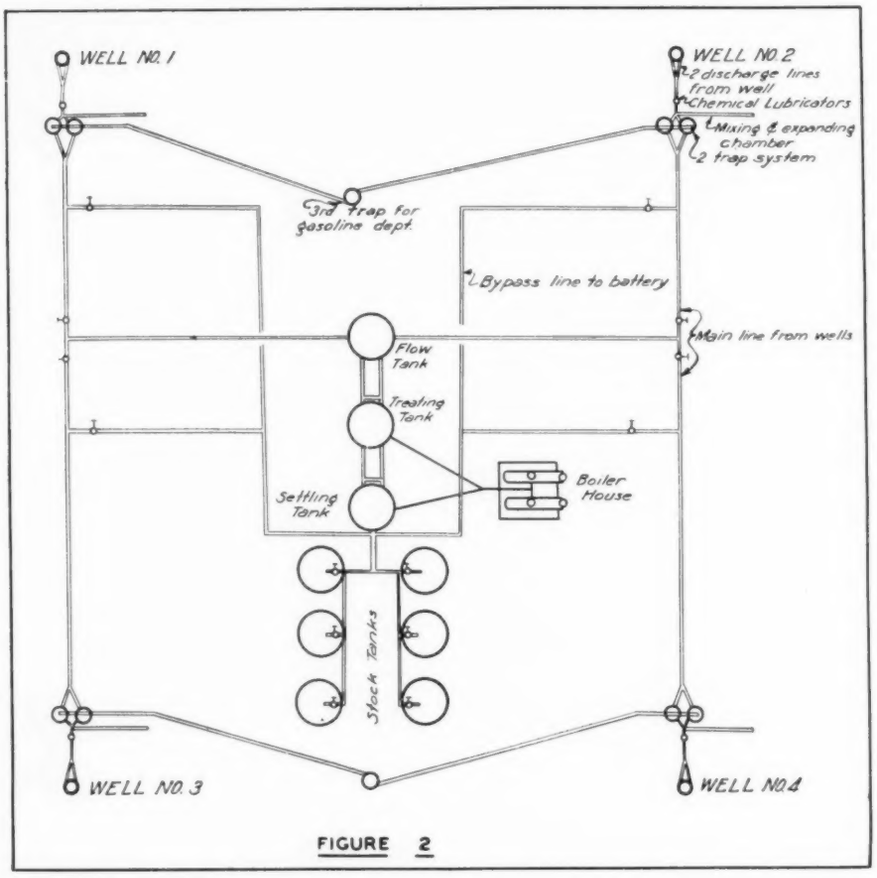

FIGURE 2

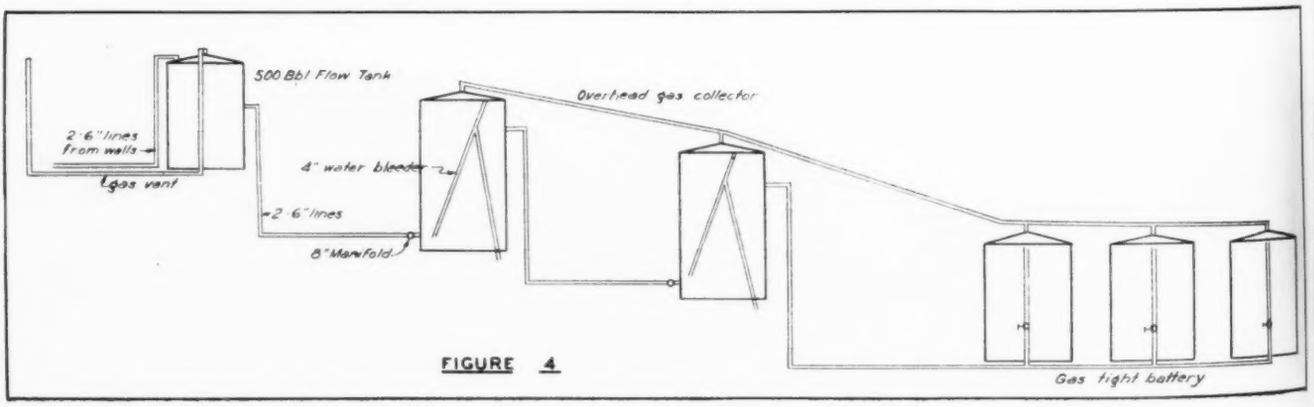

FIGURE 4

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"Our investigation has shown that a weld made with Quasi-Arc rods can be bent, twisted or forged *without cracking*, whereas welds made with ordinary rods cannot be so treated, Quasi-Arc products making more ductile welds."

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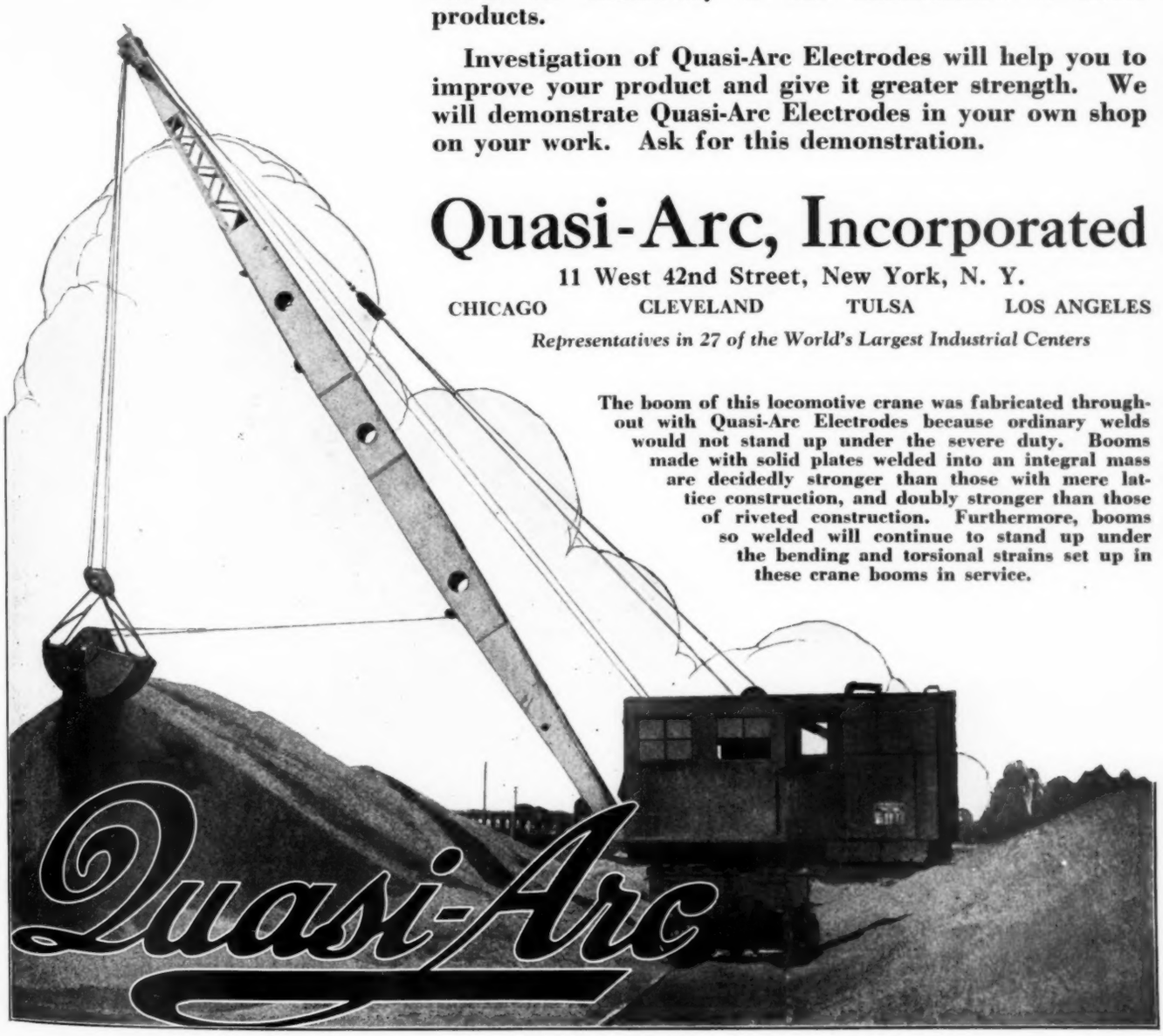

The boom of this locomotive crane was fabricated throughout with Quasi-Arc Electrodes because ordinary welds would not stand up under the severe duty. Booms made with solid plates welded into an integral mass are decidedly stronger than those with mere lattice construction, and doubly stronger than those of riveted construction. Furthermore, booms so welded will continue to stand up under the bending and torsional strains set up in these crane booms in service.

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London Company Introduces

Motor Oil Testing Laboratory on Wheels

Shell-Mex Limited's "laboratory on wheels."

THE ordinary motor car driver has little conception of the lengths to which the larger oil companies go in their research work to test and develop motor vehicle oils. Laboratory tests have enabled chemists to introduce many improvements in motor oils, but in the laboratories actual road conditions are lacking.

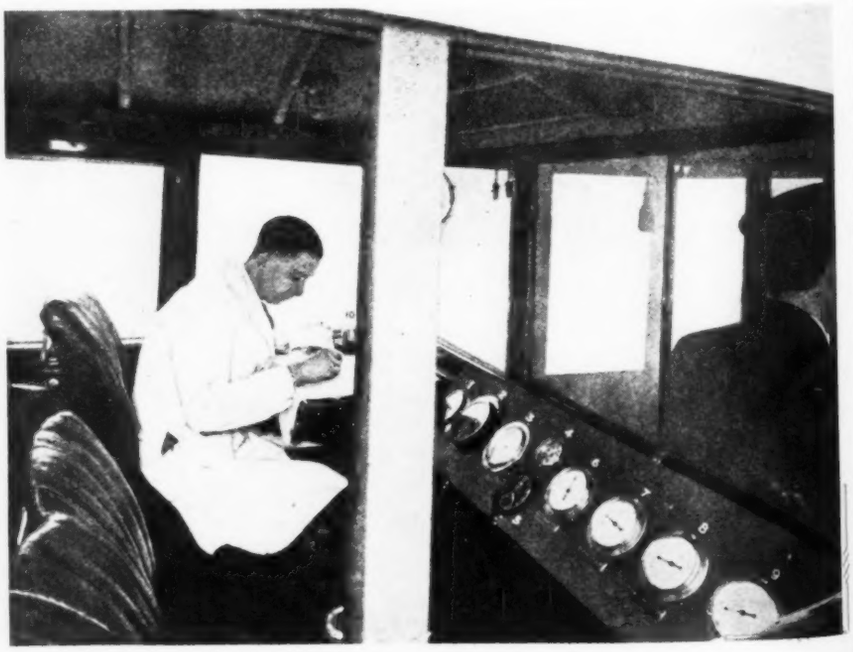
Shell-Mex Limited, London, through its laboratory on wheels, has enabled scientists to watch the performance of lubricants under actual road conditions. The lorry is typical of the fast bus and long-distance coach chassis so common in Great Britain.

An observation cabin, extending the width of the chassis, is behind the driver, who sits in the usual position. The observation cabin is enclosed with glass. It has a long dashboard for the instruments, a table for writing, and seats for three persons, although only one is usually carried. The rest of the body is an ordinary platform.

The petrol tanks are built to hold three grades. The arrangement of pipes and taps is such that the observer can switch the engine from one to the other.

Samples are taken from the engine sump every 250 miles for laboratory examination. An especially easily operated cock in place of the usual drain plug, and covered with chamois leather, is provided for this purpose.

The instruments in the observation cabin are specified as follows: 1—Speedometer, indicating actual road speed in miles per hour with a secondary scale showing the mileage of any special trip. This apparatus is positively driven from the gear box. 2—Engine revolution counter, which indicates the crankshaft speed and, by comparison with the road speed, an indication of the gear in use can be readily discerned. This apparatus is positively driven from the camshaft. 3—Aneroid barometer, giving the height in feet above that of the starting point (standard) as well as atmospheric pressure. 4—Oil pressure gauge, which indicates the pressure in pounds, per square inch, in the oil circulating system. 5—Clock, fitted with a stop-clock action so that trips or stops can be recorded accurately. 6—Distant reading chemical vapor thermometer with 12-foot lead, the end of which is immersed in the water at the top of the radiator. 7—Distant reading chemical vapor thermometer with 12-foot lead, the end of which is immersed in the oil in the engine sump. 8—Distant reading chemical vapor thermometer with 12-foot lead, the end of which is immersed in the oil in the gear-box. 9—Distant reading chemical vapor thermometer with 26-foot lead, the end of which is immersed in the oil in the back axle. 10—Wimperis accelerometer and gradient meter, which indicates the acceleration in feet per second from stationary or steady speed.



Observation cabin of the motor lorry.

Canfield's Coraopolis Plant Uses Modern Processes in

Refining Wm. Penn Motor Oils

THE high quality of Wm. Penn Motor Oils, 100% pure Pennsylvania, are manufactured in the Canfield Refinery at Coraopolis, Pa. Many modern processes are used in the plant in order to produce this grade motor oil from the crude. Unlike most Pennsylvania refineries, there is no wax plant in this refinery, since all of the lubricating oil is dewaxed by means of centrifuges.

The procedure employed in making the motor oils is to reduce the crude by means of fire and steam to the lube base, taking gasoline, naphtha, kerosene, and gas oil off overhead. At the present time shell stills are employed for the distillation.

Filter Plant

The lube base is filtered in solution through fuller's earth to the desired color. Every precaution is taken to prevent fine clay getting into the filtered oil. The stream from the filters runs through a very fine mesh wire screen basket. A large filter plant is required to filter the oil. This plant is very modern, being equipped with conveyors to handle both the spent and the burned clay. A large furnace is used to revivify the filter clay. The furnace is equipped with pyrometers for temperature control. By means of this furnace the clay can be used about sixteen times before the efficiency becomes so low that it is necessary to discard it. All the lubricating oil made in the refinery is filtered.

The reduced wax free oil from the stills is brightened by filtering it through a shallow bed of clay in the filter. This removes all the moisture retained in the oil, and gives it a perfect emulsion test.

The filtered oil from the percolators is pumped to the centrifuge plant for dewaxing. The oil in naphtha solution is chilled to a temperature below 0° F. and run through the centrifuges. The pour point on the finished oil is about 20° F. The wax-free oil solution is then taken back to the stills to distill off the naphtha.

General view of Canfield refinery, Coraopolis, Pa., and above, a pennant awarded to the cleanest department.

Boiler House

A large new boiler house has been in use for about a year, and the modern equipment and operation can be looked upon with pride. Three water tube boilers of 350 horse power each are in operation. They are fired with slack coal as are the stills.

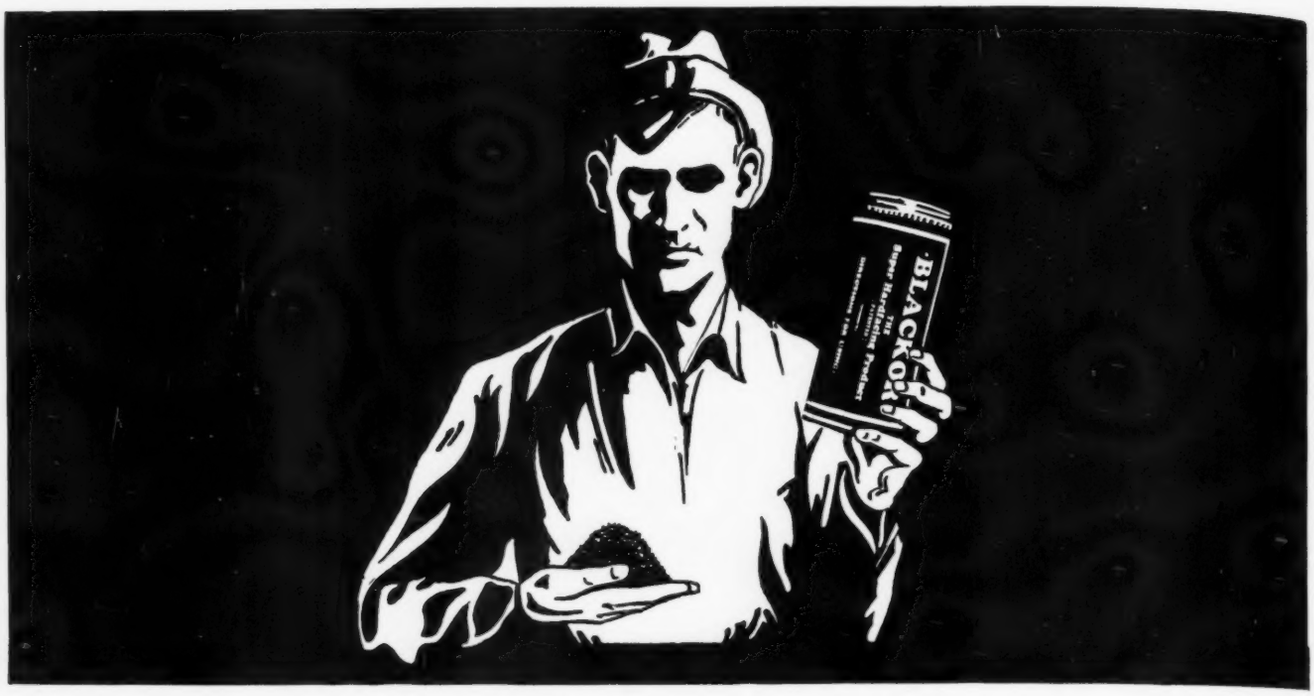
All of the coal fed to the stokers is automatically weighed and the weight recorded on a card which enables the engineer to make a complete daily report on the operation. About 9 pounds of water is evaporated per pound of coal fired. The overall efficiency of the boilers is above 72%.

The boilers are equipped with superheaters. Flow meters, CO_2 recorders and pressure and temperature recorders are used to maintain the high efficiency. The boiler feed water is purified in a softening plant. In this system the water percolates through crushed marble and gravel. The water leaving the purifier has no hardness. The treated water is stored in a 10,000-gallon tank. Before entering the boilers the water passes through a deaerator.

Barrel and Blending Department

A large barrel filling house containing blending tanks, filling and painting equipment, is required as most of the motor oil is shipped out in sealed steel drums under the Wm. Penn, 100% Pure, Pennsylvania brand. The equipment and procedure are arranged to handle a maximum number of packages economically.

A visitor at this refinery is impressed with its cleanliness. Even the clay plant is kept very clean. R. W. Helm, superintendent, said that each operating man tries to keep his department as clean as possible, as a pennant is offered each month to the department having the best record.



Your Driller Knows

SINCE the introduction of Blackor to the Oil Industry, many drillers have come to regard this hardest-of-all hard-facings as the most important part of their equipment because, with Blackor on the bits, they can make more hole...faster, and with less trouble and expense.

One of the hardest materials known and undeniably the most resistant to abrasion, Blackor prolongs the life of the bit by providing a solid wall of abrasion resistance over the entire cutting parts of the bit. There are no unprotected "in-between" spots to wear away and the Blackor cannot chip nor break off because it bonds perfectly with the molecules of the steel when applied. Blackor offers the greatest area of resistance to abrasion, which, with its close-to-diamond hardness, results in a sharper cutting edge for a longer time.

Actual results in the field show that Blackor-ed drilling tools will make more hole than when faced with any other hard-facing material. Under severe competitive tests Blackor has proved its ability to resist abrasion from 3 to 5 times longer than the ordinary hard-facing or insert material and in some cases Blackor-ed bits have lasted 10 times longer.

Blackor can be easily applied to any bit, disc, cone, etc., and requires no special tools or skill. Your own welder can apply it at the rate of 100 square inches per hour per layer for the ordinary bit.

If your driller isn't using Blackor now, let him give it a trial. The difference will astonish you!

Ask for Engineering Data

BLACKOR COMPANY

Head Office: 13,007 South Main Street
Los Angeles, California

New York Export Office: 39 Cortlandt Street

Tulsa, Oklahoma Office: 410 Thompson Bldg.

Houston, Texas Office: 616 Public National Bank Bldg.

PROTECTED BY AMERICAN PATENT PROTECTION CORPORATION

Licensed under Patent Numbers:
1,613,942
1,424,536
359,925
30,021
16,347
15,311
2,580
1,069
Reissue No. 17,323.
Other patents pending.

Blackor is packed in convenient 5-lb. watertight containers — easy to stock — easy to handle. Complete working instructions are furnished with each order. The genuine super abrasion-resistant.

BLACKOR

The Super Abrasion-Resistant Facing

When writing BLACKOR COMPANY *please mention The Petroleum Engineer*

Contrast Between ANCIENT *and* MODERN Drilling Equipment

THE highly improved modern drilling tools make an unusually sharp contrast with the crude hand-fashioned, light-weight drilling implements used in the early days of oil history.

For a number of years before the discovery of the famous Drake discovery well in 1859, drilling tools were used to drill for salt water. Several attempts were made to drill for oil before the Drake discovery, but none was a success, due to the encountering of rock formation that caused the pioneer drillers to give up in despair. The early tools were hammered out on an anvil, and the threads cut with a cold chisel. These were operated from a spring pole.

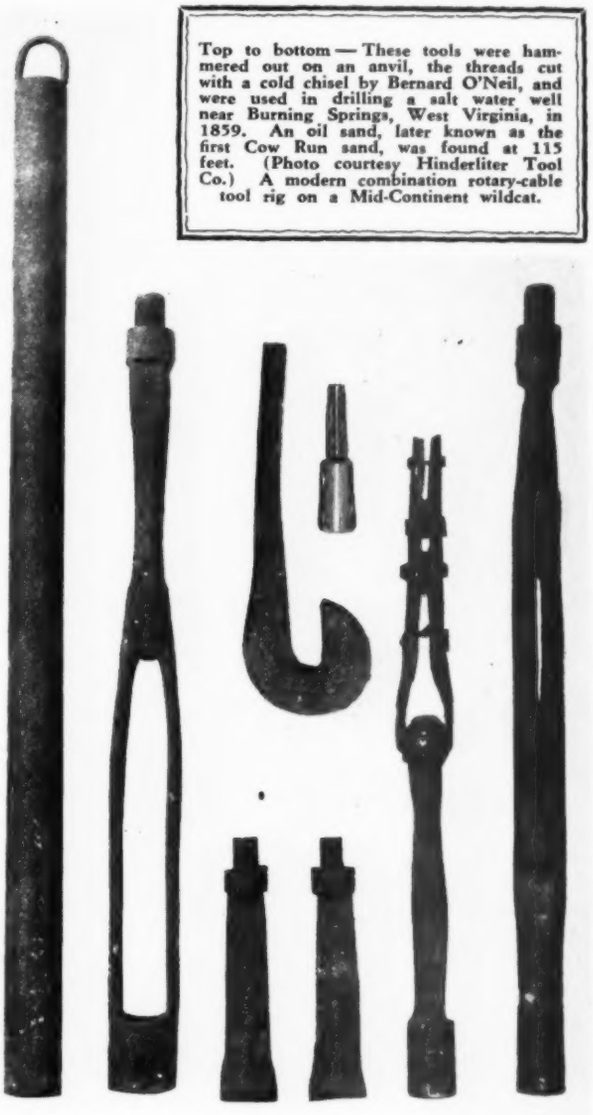
An early account of the attempts to find oil production, then used for medicine, is a try by a man named Nelson in 1845. Nelson became interested in petroleum, then called rock oil, because Barnard O'Neil, a neighbor of his living across the Hughes River, Ritchie County (now West Virginia), had found the greasy fluid when digging a well for fresh water purposes.

O'Neil was at first much disappointed, but later found that the greasy fluid was the miraculous Rock Oil medicine, then commanding such a high price. He started producing the oil and marketing it with much success, thus attracting the attention of many others. After making a trough from a tree, he placed a blanket on the end of a long pole which he lowered into the well and allowed to soak up with oil. The blanket was then wrung out into the trough and the oil bottled for market as medicine.

Nelson decided to try and find rock oil on his side of the river and, being of a mechanical turn of mind, he conceived the plan to drill with tools used at that time for drilling for salt water. He had witnessed the use of such tools at Burning Springs, a short distance away.

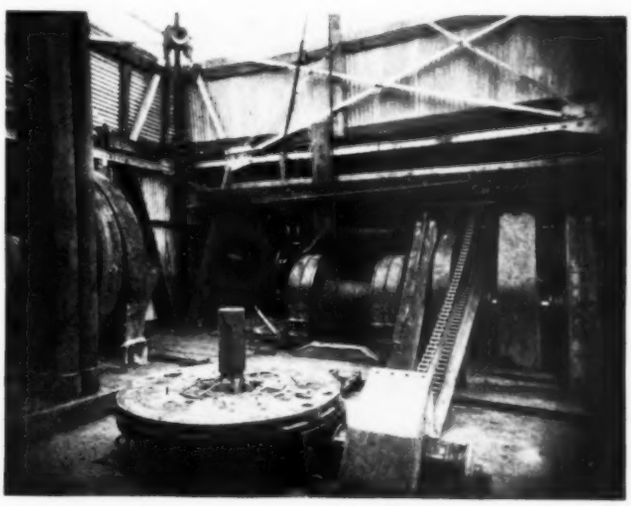
The tools were soon fashioned and drilling commenced. The operation was successful until he reached the depth of the O'Neil dug well, where a rock formation was found that caused him to give up in despair. This was in the year 1845. Later development has proven that if he had penetrated this rock formation he would have opened an oil pool.

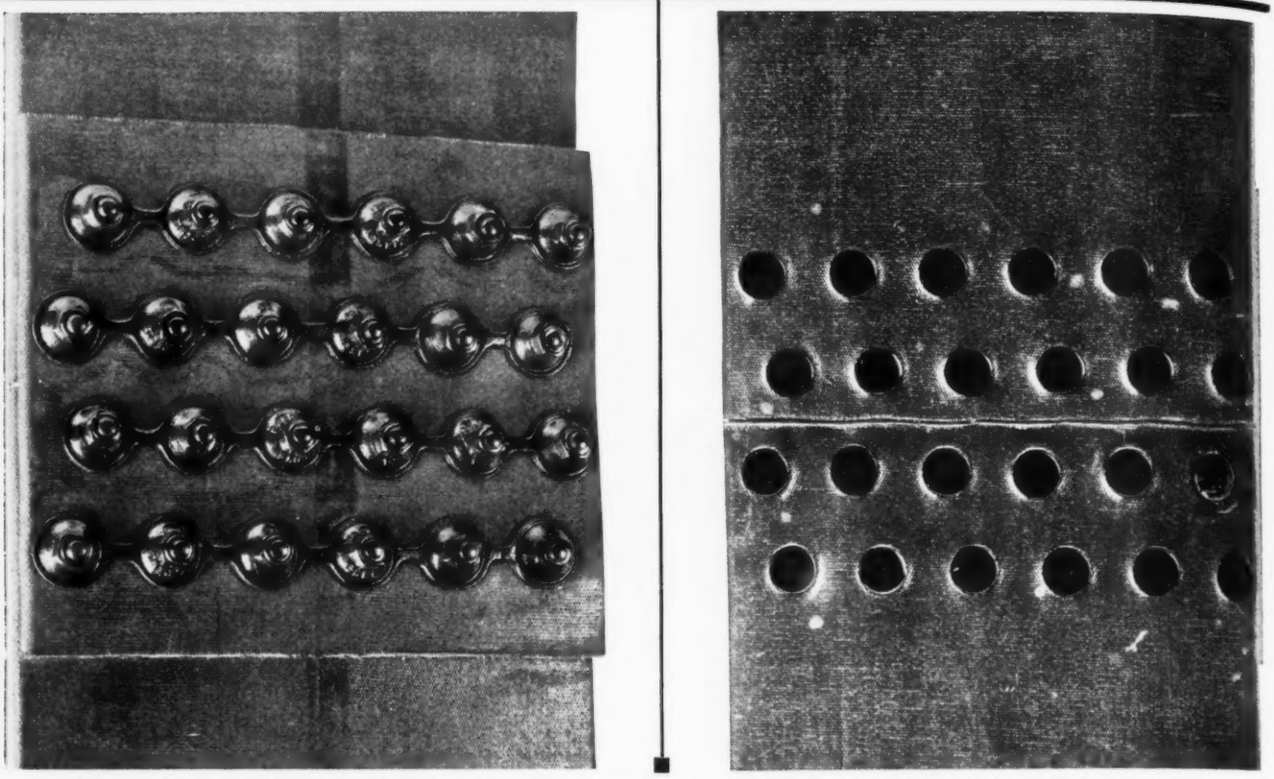
The tools made by Nelson were, in after years, secured by T. H. Murphy, a pioneer in the Volcano and Burning Springs pool, who stayed with the oil business until his death some few years ago.



Top to bottom — These tools were hammered out on an anvil, the threads cut with a cold chisel by Bernard O'Neil, and were used in drilling a salt water well near Burning Springs, West Virginia, in 1859. An oil sand, later known as the first Cow Run sand, was found at 115 feet. (Photo courtesy Hinderliter Tool Co.) A modern combination rotary-cable tool rig on a Mid-Continent wildcat.

Modern equipment for a deep rotary test taken before being housed.





Photos showing both back and pulley side of fourteen-inch belt fastened with SKINNER'S saddle back clamp.

Skinner's Saddle Back Clamps

» » » are easy to install and less dangerous to workmen.

Prevent broken bolts and make a 50% stronger splice than old style clamps.

Belts cannot pound in two between clamp and pulley.

Keep plies as well as ends of the belt together.

Belt manufacturers and salesmen recommend them.

Each invoice for Skinner's Belt Clamps is an insurance policy against most of your belt trouble and expense. A post card will bring you full information concerning the application of these clamps. » » Start using them today.

U. S. Patent 1736377

SKINNER BROS. BELTING COMPANY

Tulsa, Oklahoma Phone 2-9227 » » **Wichita Falls, Texas** Phone 5630 » » **Beaumont, Texas** Phone 2635

New System of Oil Tanker Protection

THE Standard Oil Company of California announces the dedication to public use of one of its most important developments in the fire protection field, a system by which explosions on tank ships are made virtually impossible.

During the past few years a number of such explosions have occurred, in some instances with serious loss of both life and property. Generally speaking they are the result of the accidental ignition of the highly explosive mixture of oil vapors and air formed when a volatile oil such as crude or gasoline is pumped out of a tank ship, and air flows into the tanks to take its place.

While Standard Oil of California's fleet has been fortunate enough never to have suffered such an explosion, the company has realized the danger under which tankers inherently operate, and several years ago company engineers started investigating methods by which the potential hazards could be eliminated. Realizing that an explosion cannot occur unless the oxygen of the air is present to combine with the petroleum vapors, the simplest and most direct way of eliminating the hazard appeared to be some means of filling the tanks with some gas which contained little or no oxygen.

Fortunately, no special apparatus for the manufacture of such a gas is necessary on a steamship, for tremendous quantities of flue gas, from which the oxygen has been consumed by the boiler fires, are constantly passing up the stack. This is, of course, a waste product which, when properly cooled and washed makes an ideal inert gas for introduction into the vapor space of the cargo tanks. The accompanying sketch shows diagrammatically the way this plan has been put into effect on several Standard Oil ships.

At first thought, this plan of putting gases from the boiler fires into a ship's tank might appear to be anything but a safeguard for the ship, but if the layout is examined it will be seen that, as the gases are withdrawn from the stack, they flow through a washer in which a deluge of cold salt water brings the temperature of the gas down to practically that of the sea and washes out any soot that it may carry. As a still further safeguard, an automatic valve on the cooler outlet is held open by a steam piston against the pressure of heavy springs. Steam is supplied to the piston from the steam jet pumps used to pull the flue gas from the stack; should the steam supply fail, the valve closes instantly. A connection is also made in such a manner that even partial interruption of the cooling water supply will release the steam pressure and permit the valve to close. Thus, no hot gas can possibly find its way into the cargo tanks.

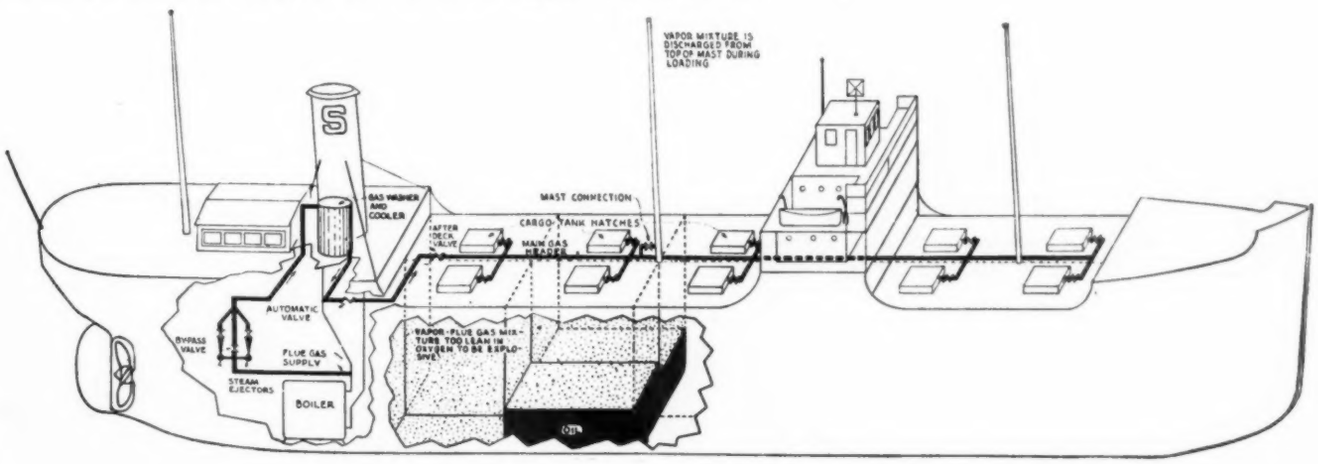
A flue gas system of the type described safeguards a tanker in three principal ways:

1. By keeping oxygen from getting into the tanks when they are emptied, it insures that during the period of unloading and the return voyage empty, the tanker's compartments are so thoroughly protected that they could not be ignited even if someone deliberately plunged a flame into them.

2. During the period of loading, the vapors, instead of being pushed out through the "ullage holes" onto the deck as is the case in an ordinary tanker, can all be collected through the flue gas piping system and discharged, through the connection shown in the sketch, up and out the top of a hollow mast. This eliminates one of the most hazardous conditions of ordinary operation; for when a tanker not equipped with such a system is loaded, a constant flow of highly combustible vapor is discharged onto the deck of the ship—where workmen must walk to and fro regulating valves, getting back and forth from quarters, etc.

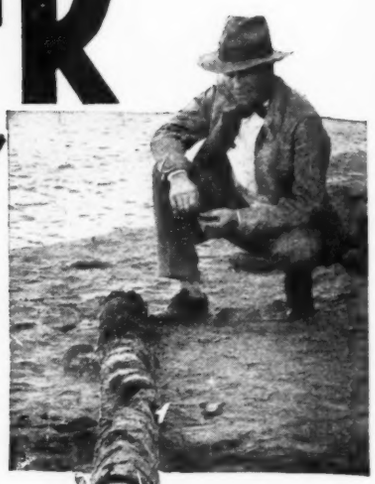
3. When it is desired to clean a tanker, flue gas can be blown into the bottom of the tanks through the cargo lines; and the mixture of residual petroleum vapors and flue gas discharged through the flue gas lines up the mast. By this process practically all of the petroleum vapor can be quickly swept out of the tanks; and then when the tanks are opened up to be swept out with fresh air by wind sails, there is no chance of passing through an explosive range as would be the case when fresh air flows into tanks containing straight petroleum vapors. Some of the worst tanker accidents have occurred during cleaning operations; flue gas equipped ships are effectively safeguarded against such accidents.

The first Standard Oil tanker to be equipped with this protective system was the S. S. "H. M. Storey" on which the system was put into commission in May, 1927. Six other tankers have since been similarly equipped. Despite the mechanical difficulties inherent in any such new development, the systems on all these ships have functioned as planned.



for LARGER CORES FROM THE LARGEST HOLES

Elliott Type "W"
Rotary Core Drills



This core drill will bring up five and six-inch cores up to twenty-six feet long while cutting full gauge hole from 11¼-inch to 25-inch, inclusive.

The illustration is from an unretouched photo of a six-inch core, fifteen feet long, recovered with an Elliott Type "W" Core Drill—photo taken after breaking up the core.

Complete information covering the Type "W" drill will be supplied on request.

ELLIOTT CORE DRILLING CO.
4731 East 51nd Drive
LOS ANGELES, CALIFORNIA

Mailing Address:
P. O. Box 55 Maywood, Calif.

Export Office:
150 Broadway, New York

Distributed exclusively in the United States east of the Rocky Mountains by REED ROLLER BIT COMPANY

DEVELOPING Shallow Fields *in* CANADA

By
D. AUSTIN LANE

DEVELOPMENT in shallow fields bids fair to correct the impression that has gone abroad that oil development in Alberta, Canada, is largely a deep drilling proposition.

In Turner Valley, the chief field in the province, production is obtained from the dolomitic limestone at depths of 3,700 to 6,500 feet. The shallowest depth at which the lime has been encountered in this field is 3,220 feet — at Royalite No. 14—and the depths of wells in the limestone vary from 100 feet to 1,600 feet. The cost of each of these wet gassers, from which naphtha and a very high grade crude are obtained, that have a daily flow, in some cases of 30,000,000 cubic feet, is at least $150,000.

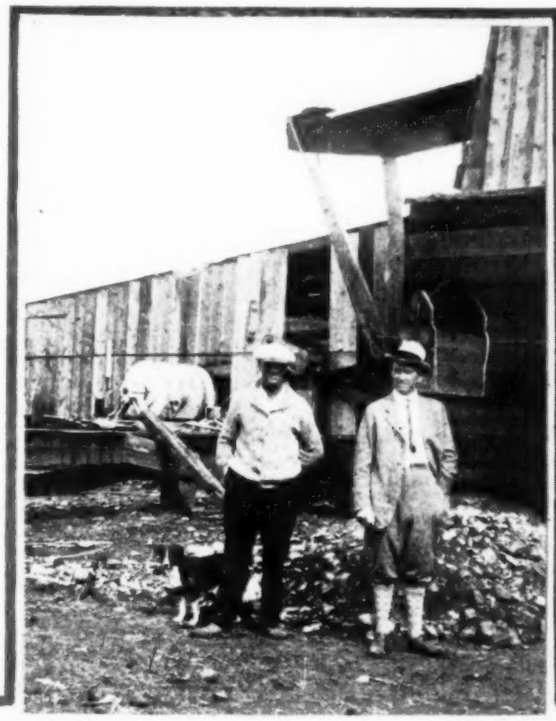
However, there are a few wells from which the ordinary crude is secured at higher levels, but in every case it is necessary to be prepared to go to the limestone sooner or later.

The results recently obtained in shallower fields, such as Red Coulee and Ribstone, have been a godsend in these days of financial stringency.

Alberta development depends largely on the sale of issues by public subscription, and many a company which could only raise the price of purchasing a rig to drill in Turner Valley is now in a position to complete a well in one of the shallower fields. It only costs $18,000 to $25,000 to drill to the production level in Red Coulee, Ribstone or Wainwright. In some of the fields in the foothills belt, where harder formations, steeper dips and greater foldings are encountered, the cost is somewhat higher.

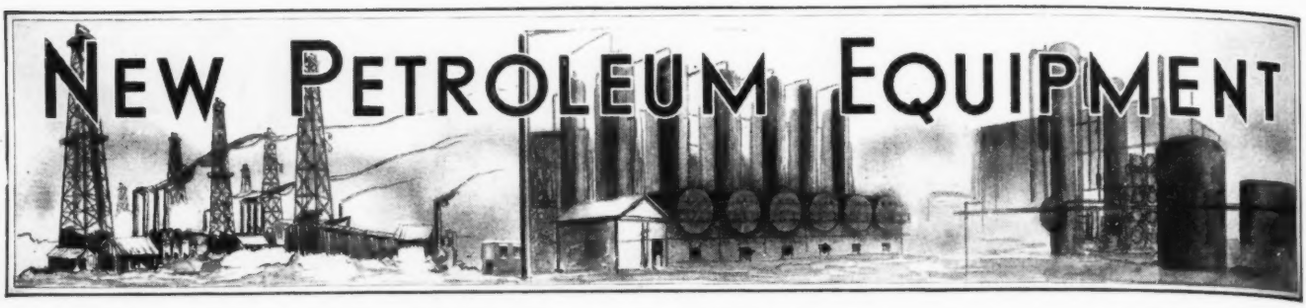
In the palmy days of the Kevin-Sunburst field in Montana, several Alberta companies played an important part in drilling activities. A number of Montana operators are turning their attention to Red Coulee international structure, which was proven right along the boundary last autumn by Vanalta No. 1. The next producer in that field was Mid-Continent No. 1 on the Montana side of the line, offsetting Vanalta. Both companies were financed by Canadian capital. These producers started an international offset war, which has every indication of being extended on a big scale before the end of the summer. Vanalta No. 1 reached the Vanalta sands from which it is producing at a depth of 2,470 feet. Its initial output was around 80 barrels per day. The well was somewhat imperfectly completed, it being necessary to run casing several times. Mid-Continent, which was more fortunate, did 100 barrels per day when it was brought in.

Cosmos, a later completion, just south of the line, is producing from two horizons — the Vanalta sands at a depth of 2,575 feet, and the Sunburst sands higher up.



Top — (Right) W. S. Herron, of Turner Valley field, who is now pioneering on the Herron structure west of Calgary, with a member of the crew.

Left — Well of Moose Oils, Ltd., amid picturesque surroundings on Moose Dome, west of Calgary, Alberta.



New Guiberson Four-Disc Bit

SEVERAL features are incorporated in the new Guiberson four-disc bit. In the first place, there are four discs instead of two. The great cutting area of four discs naturally gives each cutter much less work to do than when only two are used. In the Guiberson bit the two inside cutters drill out the core, thus relieving the outside cutters of the reverse drag. This allows them a free roll with a slicing cut and eliminates flat cutters.

The inside cutters and the outside cutters have offset axes and therefore the spaces between them are naturally kept clear by the revolution of the cutters.

The cutters do not fit snugly on the axes. A certain amount of play is allowed between the cutter and the axle, which, with the convex bearing surface and the tapered faces, allows the cutter to work in its most efficient plane of rotation. By this means the action of cutting throws the forward and downward cutting edge outward, thus cutting a considerably larger hole than it would otherwise cut. It also gives the cutters a wobble, which, with the chisel shape of the cutting edge, tends to keep them sharp.

The side plates have reamers fitted into them for the purpose of keeping the hole full size as the cutters wear down.

Water flush holes are carried to the bottom of bit so that water is discharged at exactly the right point to keep the bottom of the well clean, flush the cutters and open fresh surfaces of the formation to the cutting edges of the bit.

While not intended as a rock bit, it will readily cut through short intervening shells, making it unnecessary to pull out and change bits. It is likewise unnecessary to ream the hole after drilling with this bit, since it is already reamed full size.

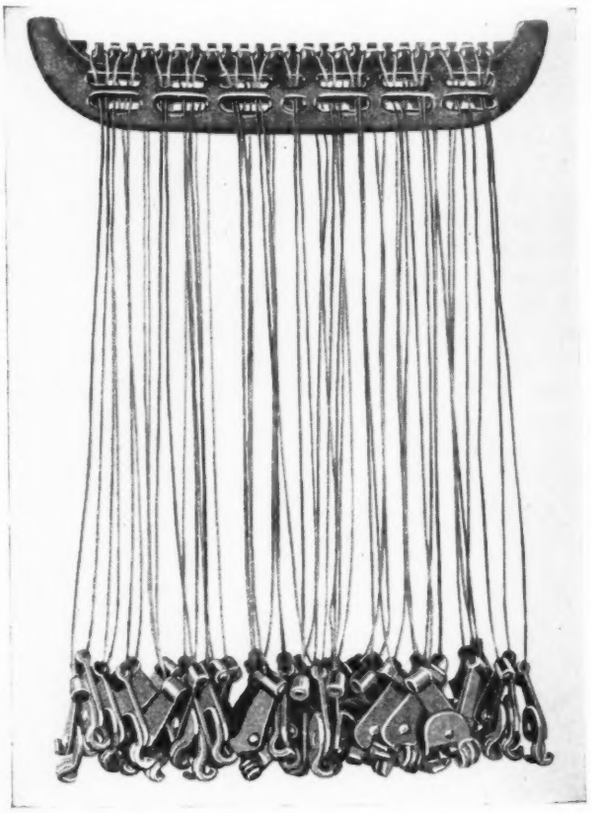
For most effective running, a rotary speed of 60 to 70 r. p. m. is found best, and the entire weight of the drill stem should never rest on the bit except when starting the hole. With a weight indicator on the rig, the driller can soon learn the most efficient load to put on the bit and the most efficient speed at which to run it. The bit is manufactured by The Guiberson Corp., Dallas, Texas.

Surveying Crooked Holes

"SURVEYING Crooked Holes" is the title of a pamphlet being distributed by Rieber Instrument Corporation of Los Angeles and San Francisco, Calif. Contributing Causes of Crooked Hole, Disadvantages of Crooked Hole, Potential Losses of Crooked Well, Why Wells Should Be Surveyed, Checking Deviation of Hole at Start, Requirements of Surveying Apparatus, Basic Types of Surveying Instruments, are various phases of this important subject discussed. Besides description of the construction, use and features of the Rieber surveying instruments are given.

"Sotco" Announces an Improved Sucker Rod Hanger.

THE Specialty Oil Tool Company of Los Angeles, manufacturers of Sotco oil well fishing tools and other practical oil field specialties, announce an important improvement recently made in the Sotco Wigle Sucker Rod Hanger — a device which not only holds the rods safely



out of the way in a compact group, but also has long been in favor for its value in speeding up pulling jobs.

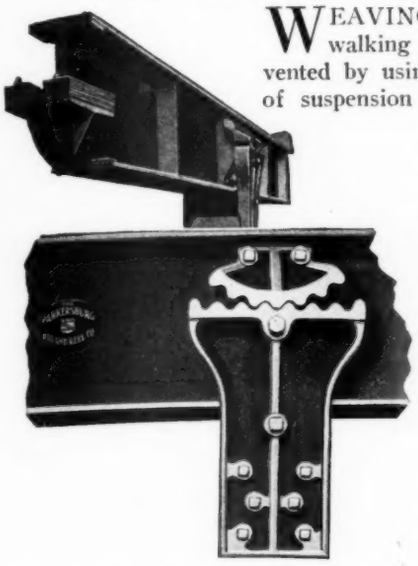
The improvement now incorporated in this hanger, makes it possible for any part of the sucker rod to be engaged instead of depending on the rod coupling for engagement, with the result that the rods may be properly and evenly placed in the derrick without undue waste of time and labor, the manufacturer claims.

The Sotco Wigle Improved Sucker Rod Hanger, as shown in the accompanying illustration, will accommodate up to 60 stands of ¾-inch rods. It is constructed of cast steel and is designed to withstand hard usage.

Shaffer Control Gate Booklet

A BOOKLET from the Shaffer Tool Works, Brea, Calif., describes the Shaffer Control Gate, its purpose and method of operating. A number of illustrations show the make-up of the gate. Other equipment of the company and its distributors is listed.

New Oil-Less Walking Beam.



WEAVING or side sway of walking beams is now prevented by using a new principle of suspension which also equalizes the load, improves the stroke, and eliminates need for lubrication. This is introduced in the Type "ICR" Walking Beam made by Parkersburg Rig & Reel Company, Parkersburg, W. Va.

Unlike the usual walking beam saddle, with trunnions operating in side iron bearings, the new "center rocker" suspenion consists of cogged rocker saddles, one attached to each side of the beam, which rock on cog racks mounted on any A.P.I. drilled Sampson Post.

The rocker saddles, on the same horizontal line with the temper screw or pumping hanger bearing, not only prevents weaving but also permit a long, straight stroke for drilling or pumping service, the manufacturers state.

The "ICR" Type Walking Beam illustrated is a heavy 24-inch I-beam, amply reinforced, and is available in 24, 26 and 28-foot lengths as desired. The manufacturer also furnishes several types of steel walking beams for both drilling and pumping service.

New Trackson Circular

AN attractive eight-page circular issued by the Trackson Company, Milwaukee, Wis., describes the outstanding features of the new Trackson crawler wheels. These wheels are built for mounting on various makes of wagons, bummers, etc., and the circular will be of interest to everyone in the oil and gas and pipe line industries whose operations involve hauling material and equipment.

Axelson Type "B" Aircraft Engine Book.

A HANDSOMELY bound instruction and parts book for Axelson Type "B" aircraft engine has been published by the Axelson Aircraft Engine Company, P. O. Box 337, Los Angeles, Cal. The book contains 127 pages, with 37 photographs and 9 plates, as well as general description, complete instructions for installation, operation, trouble-shooting, inspection, top overhauling and complete overhauling. Parts are listed numerically, alphabetically and by sub-assemblies. The book comes in loose-leaf form to permit insertion of additional data from time to time. The price is $2.00.

Stockham Pipe Has New Executive

THE Stockham Pipe & Fittings Company announces with pleasure the appointment of Germer Petesch as assistant general sales manager, with headquarters in Birmingham.

Because of long association with the manufacturing end of the business, and after several successful years as Chicago manager and in other sales divisions, Mr. Petesch brings to his new position thorough knowledge of the Stockham lines and a valuable selling experience.

Ideal Barrel Pamphlet.

HOPKINS & DEVOLLD, Bartlesville, Oklahoma, has issued a small pamphlet on "The Ideal Barrel." This barrel has a sand protecting device which protects the cups while pumping. The pamphlet gives full instructions on installation of the barrels as well as a listing of the parts.

The "Chiksan" 3-Way Disc Pit and Reamer Described.

CHIKSAN OIL TOOL COMPANY, LTD., Fullerton, Cal., is circulating an illustrated, descriptive pamphlet on the "Chiksan," a 3-way disc bit and reamer. Its advantages and make-up are explained.

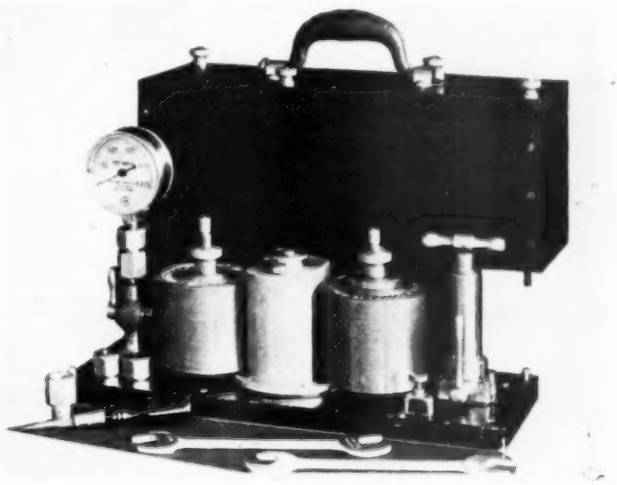
General Electric Bulletins.

"ARC Welding in Industry," is a bulletin in book form put out by General Electric Company of Schenectady, N. Y. The book has a number of articles on the latest welding developments, with much space devoted to illustrations.

General Electric Company has also published bulletins on its G-E Strip Heaters; Enclosed Starting Rheostats for Repulsion-Induction Motors; G-E Automatic Welding Head and Control; Solid-Shaft, Vertical Induction Motors, 500 series; G-E Fabroil Gears; G-E Textolite Gears, and Type RKS Capacitor Motors.

THE accompanying picture is a good reproduction of the dead weight tester designed and manufactured exclusively by the Tulsa Fine Mechanic Shop, of Tulsa, Olakhoma, located on the corner of East Third and Frankfort streets. The instrument was designed by the shop's manager, Mr. East.

It is neat, compact and the complete weight with cover is only 50 pounds, and tests gauges accurately from 5 pounds up to 1,000 pounds.



It is an oil fluid hydraulic system, and can be easily operated with two fingers, clean, sanitary, and no leakage.

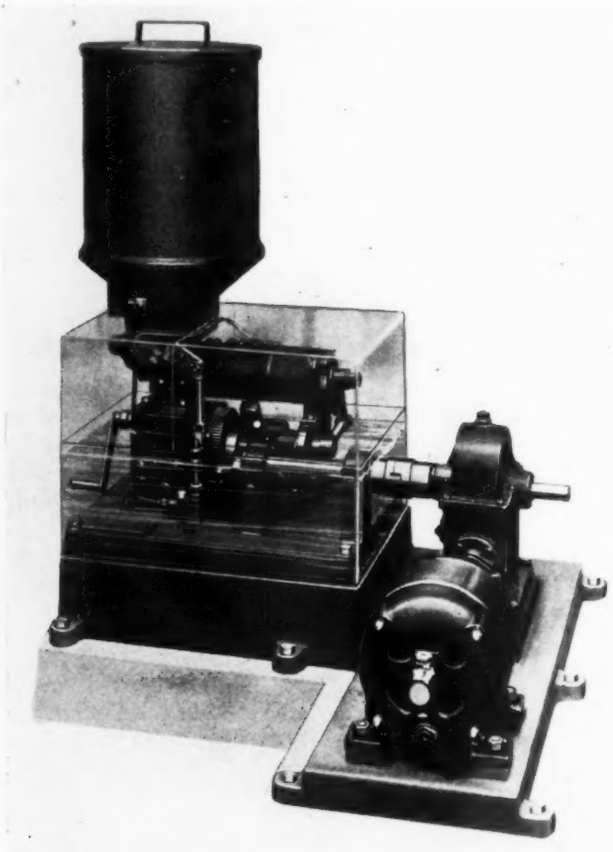
When the cover is placed over it, it resembles a grip, and is carried as such. The necessary wrenches, screwdriver, hand puller and four connections for different sized gauges, with double sleeve lock nuts are all enclosed within the tester.

One of the best features is the fact that this tester can be taken to the plants and gauges repaired on the job.

Hills-McCanna Anderson Mill Type Grease Pump.

BECAUSE the trend in present day equipment lubrication runs to heavier and more viscous materials — grease difficult to handle, but more effective when properly applied — the Hills-McCanna Company of Chicago announce the marketing of a new type of grease pump offering a fully mechanical means for pumping heavy mill greases.

Like the Hills-McCanna lubricator on which basic patents were secured for feeding given quantities of clean, fresh oil to bearings and cylinders — the grease pump (Anderson Mill Type) is another step in lubrication, the manufacturer believes. It is a device of surprising simplicity and rugged construction capable of high pressures. There is no dependence on air, hydraulic or spring pressures. It is positive—delivering measured quantities of lubricant to the surface to provide a thorough protective film.



The hazard of personal injury ever present where hand feeding is employed is thus removed by substituting mechanical means. Accuracy is assured against any pressure and the pump will handle any grease at present developed, the manufacturer states.

The grease is introduced into the feeding system of the Anderson Mill Type Grease Pump by means of a displacement pump operating a positive mechanical valve opened on the suction stroke, and closed prior to the discharge stroke. A distributor head with the requisite number of leads is directly connected to the discharge side of the pump. The indexing of the head is secured by means of a ratchet attachment which allows indexing on the suction stroke of the pump and remains fixed during the discharge stroke, after which it indexes to the next lead and continues in order.

The Anderson grease pump is built in sizes according to the number of feeds required. Present models consist of 4, 6, 8, 10 and 12 feeds per unit. Special sizes are made up to 24 feeds per unit. Where more than 24 feeds or leads are needed, two or more units may be connected with a common driving mechanism to secure the desired number of feeds. The pressure capacity of the Anderson pump is sufficient to deliver grease under any bearing pressure to a maximum of 5,000 pounds per square inch.

Further particulars and a bulletin may be secured by writing the manufacturer, the Hills-McCanna Co., 2349 Nelson St., Chicago, Illinois.

New Chain Belt Catalog

THE Stearns Conveyor Company, Cleveland, a division of Chain Belt Company, Milwaukee, has recently completed a catalog and engineering data book containing complete and specialized information on the designs and application of Rex-Stearns Timken Idlers for all types of belt conveyors, together with all allied and auxiliary equipment necessary for complete belt conveyor installations.

Rex equipment, made by the Chain Belt Company, includes a broad line of chain and power transmission equipment — conveyors and conveying systems for an important series of industries, mixers, pavers and many other items of construction equipment as well as a great number of allied products.

New J. A. Campbell Company Catalog.

A NEW catalog describing the entire line of gasoline plant equipment manufactured by the J. A. Campbell Company of Long Beach, California, is being forwarded to numerous executives and engineers throughout the petroleum industry.

Unfolding a most interesting story of the background of engineering research and practical field work which preceded Campbell products, the catalog also reveals some of the modern methods of shop and erection practice which have made possible the construction of complete and permanent plants in from 25 to 35 days.

Full descriptions are given of the various units employed in present day Campbell gasoline plants, including absorbers, cooler units and towers, heat exchangers, pre-heaters, distillation systems, boiler plants, pumps, stabilizers and allied types of equipment, all of which are entirely automatic in their operation.

Information of practical value to engineers is contained in the comprehensive data and detailed illustrations of Campbell Oil-Froth Absorbers and Campbell Mist-D-Fiers along with information required for selecting these units.

The catalog also contains an interesting summary of the different products the Campbell company has contributed to the industry. Copies may be obtained by writing the company at its Long Beach address.

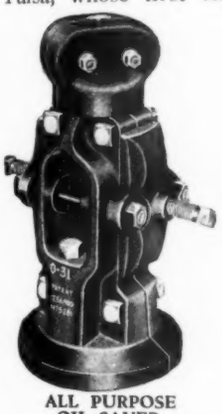
Welders Supply Company Opens New Branch.

THE Welders Supply Company of Tulsa, Olka., has opened a new branch store at Oklahoma City. Jean Newman and S. K. Bush are in charge. The same policy of "Everything for the Welder" will be upheld in this new distributing store.

New "All Purpose" Control Head

THE "All Purpose" Control Head, shown for the first time at the International Petroleum Exposition last fall, is now ready for the market, according to announcement made by the Oil Well Improvements Company of Tulsa, whose first shipments of the equipment have recently been made to American and foreign fields.

With "set screw" top flange for oil saver and "lubricating flange" above which permits use of control head for running tools under heavy flow or gas pressure, as in case of Type "X" Control Head. In "lubricating" tools, three joints of casing are used in top of control head, and this chamber of casing is closed on top with "All Purpose" Stuffing Box. Fittings shown in illustration for by-passing pressure to lubricating chamber are not furnished with the control head. Standard lease fittings are used.



ALL PURPOSE OIL SAVER. Equipped with swivel roller top to accommodate pull of drilling line, and double packing rubbers which are "cross-packed" on the line. Note extra heavy construction, thick base and "over-size" parts.

ALL PURPOSE STUFFING BOX.

The heads are semi-steel construction, are oil tested to 3,000 pounds up to 9-inch O. D., and can be converted into either "set screw," "latch assembly" or "lubricating in" types. The head is sold with either set screw, or latch assembly top, and threaded in the bottom for casing size and thread desired.

Features of the "All Purpose" control head include:

Two by-pass openings for: (a) relieving pressure; (b) mudding off gas; (c) steam line connection; (d) by-passing pressure to lubricating chamber for running tools under pressure or heavy flow.

Shoulders on by-pass openings provide anchor lugs for anchoring control head to derrick or "dead men." Companion flanges for changing thread or reducing casing size.

Lubricating flange available for attachment to "set screw" flange for converting to "lubricating-in" control head similar to type "X" for running tools under heavy pressure or oil flow.

"All Purpose" heads from 4¼ to 9-inch O. D. have same size top and take same size oil saver. This enables the operator to reduce casing size from 9-inch down without buying a new oil saver.

A special "All Purpose" oil saver is furnished of extra heavy body construction and "over-size" parts to withstand heavy pressures. The oil saver is equipped with swivel top to accommodate the pull of the line, and contains double packing which is "cross-packed" on the drilling line to minimize leaking.

The "All Purpose" stuffing box, for closing the top of the lubricating chamber for running tools under pressure or heavy flow, is similar in construction to the type "X" stuffing box used in connection with the type "X" lubricating control head made by the Oil Well Improvements Company.

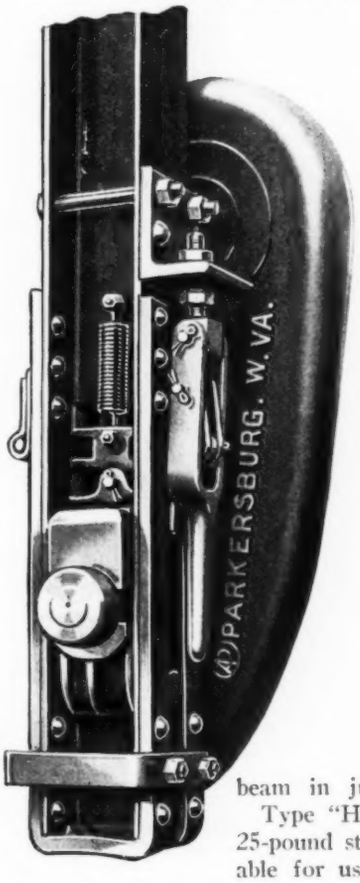
The fittings used for by-passing pressure to lubricating chamber, as shown in the illustration, are standard lease fittings and not furnished by the control head manufacturer.

Oil Country Pipe Publication.

THE latest booklet of the Youngstown Sheet and Tube Company is entitled "Youngstown Oil Country Pipe." It is a comprehensive, well illustrated pamphlet that not only describes in detail the various grades of pipe used in oil country work, but explains the best methods of handling all drill pipe to obtain best results in the field. Various descriptions of the processes incident to the manufacture of steel use in pipe and the processes of fabricating this steel into the finished product are also given.

Drilling Pitman by Parkersburg.

THIS new steel Pitman especially designed for drilling service, but equally well adapted for pumping, is of H-beam construction, and is known as type "HB" or "Boomer Type" Pitman. The features of this new product are: a self-lubricating, self-aligning bearing, and quick and easy removal from the wrist pin.

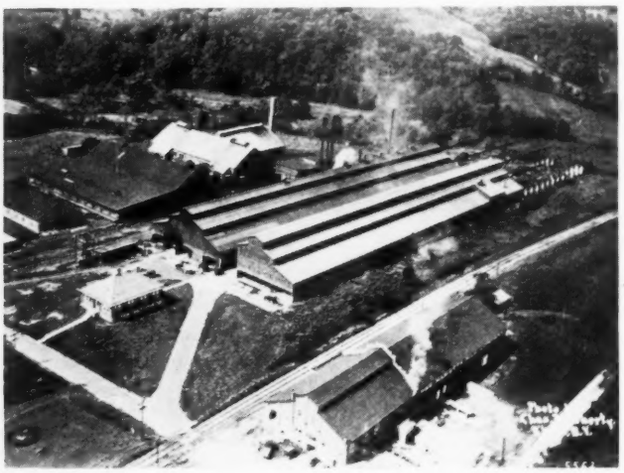


The lower half of the bearing is arranged to pivot on a fulcrum pin and align itself with the wrist pin. In this it is believed to eliminate the strain and stress caused by the weaving experienced in some walking beams in motion. The upper half is held on the wrist pin, and may be quickly released by the boomer type lever on the side. It is said that the "Toolie" can remove this Pitman from the wrist pin for pulling-out and replace it when hitching on the beam in just thirty-nine seconds.

Type "HB" Pitman is made from 25-pound steel H-Beam, and is available for use with all standard wrist pins. An oil reservoir is cast in the upper bearing to assure continuous lubrication, and the Pitman is adjustable for various lengths.

International Derrick Purchases Leidecker Tool Company of Marietta.

ANNOUNCEMENT has just been made by Harry M. Runkle, president of the International Derrick & Equipment Company of Columbus, Ohio, of the purchase of the Leidecker Tool Company of Marietta, Ohio, which adds another important production link to the nation-wide



group of manufacturing plants owned and operated by the International "Ideco" Company.

The Leidecker Tool Company of Marietta is one of the largest and oldest drilling and fishing tool manufacturers in the oil industry. It was organized in 1891 by J. J. Leidecker and his associates, one of whom was W. B. Hayes, former oil man and mayor of Pittsburgh, and G. T. Braden, deceased, former first president of the Hope Natural Gas Company and of the Oklahoma Natural Gas Company. Its growth and success has been unusual. The main plant is located at Marietta, Ohio, with branch stores and shops at Bartlesville, Okla., Basin and Casper, Wyoming. In addition to the manufacture of a complete line of drilling and fishing tools for oil, gas and artesian wells, Leidecker also manufactures a complete line of drilling machines, boilers and fittings, steam drilling engines and other similar equipment. It is the intention of Ideco to continue the manufacture of this material and to also use the plant as an eastern source for its heavy oil well machinery business.

The Leidecker plant was first located in the business district of Marietta, but in 1919 a more modern plant was built on the outskirts of the city at West View, on the Muskingum River. In 1921 a second plant was built at the same location, more than doubling the original capacity and providing facilities for further expansion.

According to Mr. Runkle, the plant is to remain in Marietta and the present organization retained. For the present it will continue to operate under the name of the Leidecker Tool Company, but back of this organization will be placed the entire sales and distribution resources of the International "Ideco" Company.

In addition to the manufacture of oil field equipment, the International Derrick & Equipment Company is one of the largest manufacturers of standardized steel buildings in the United States.

New Distributor for Chain Belt

The Chain Belt Company of Milwaukee, Wis., announces the appointment of the Corbin Supply Company of Macon, Ga., as representatives for its complete line of chain and transmission equipment.

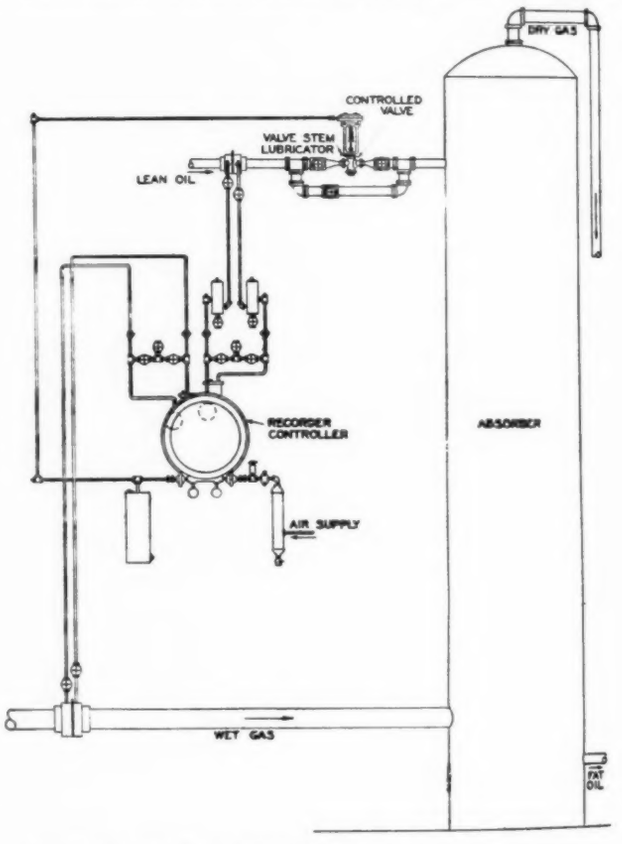
A Flow Ratio Recorder-Controller.

IN THE oil industry it is often important to keep the flow of two liquids in direct proportion to one another. When one of these fluids is an uncontrolled variable the problem becomes difficult. The Foxboro Company of Foxboro, Mass., through the development of their new controller, claim they have solved the problem. This instrument gives the desired proportions at all times, the manufacturer says.

The Flow Ratio Recorder-Controller combines the sturdy, accurate features of the Foxboro flow meter with the close control features of the Foxboro flow controller. It is two instruments in one, so connected that the rate of flow of one fluid, as measured by the flow meter, controls the rate of flow of the second fluid. The flow meter constantly readjusts the control point of the flow controller thus keeping the two fluids in the desired proportions.

For example, in an absorption plant an orifice plate is placed in the rich-gas line to the absorption tower and the flow is measured. A controlled valve is placed in the lean-oil line and the flow of lean oil is controlled in direct ratio to the flow of rich gas. When the proper ratio is worked out, the Foxboro ratio controller is said to result in perfect operation. Maximum gasoline is absorbed without the waste of lean oil. A ratio controller may also be used to control the ratio of steam to fat oil in the steam still. These are only a few of the many applications in the oil industry where a flow ratio recorder-controller can be put to work to maintain the required proportions at all times.

In fact, in any process where it is essential to maintain a constant flow ratio between two fluids, one of which is



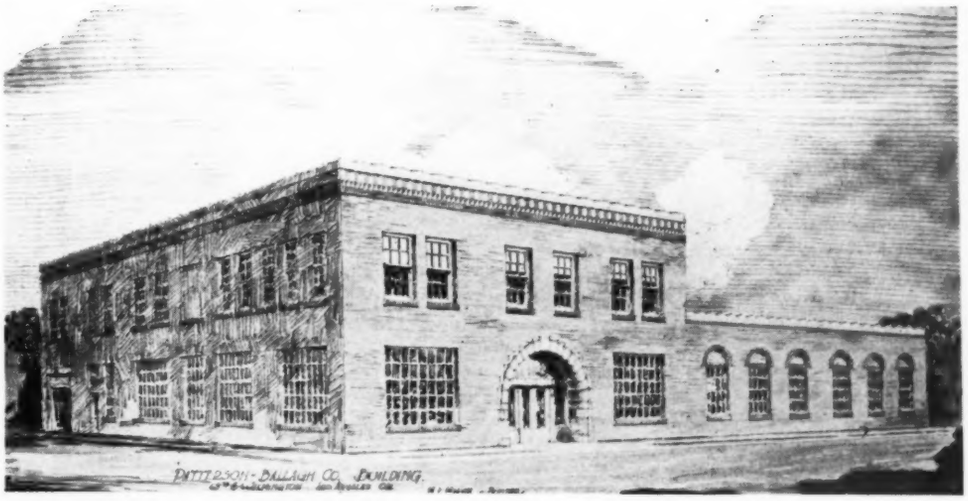
DIAGRAMMATIC LAYOUT OF RATIO CONTROLLER ON ABSORPTION TOWER

an uncontrolled variable the Foxboro flow ratio recorder-controller will handle the problem by producing a more uniform product at a lower cost, the makers state.

They further state that if both flows are controllable, Foxboro proportionate control should be used, as, for example, in lubricating oil blending.

Patterson-Ballagh Builds New Factory

ERECTION of a $250,000.00 addition to the present Patterson-Ballagh factory in Los Angeles is now under way to provide increased facilities for the manufacture of Bettis protectors, drill stabilizers and other industrial rubber products used in the oil fields.



The new factory will have three times the area of the present factory and part of it will be two stories in height. It is being constructed at 65th and Wilmington streets, Los Angeles, adjacent to the present factory, and will be completed in about thirty days, according to Jack C. Ballagh, secretary.

Patterson-Ballagh Corporation was formed about two years ago to begin manufacture of Bettis protectors, and the new plant—which will represent an investment of well over $300,000—is a result of the continued increase on the part of companies in adopting rubber protectors as standard equipment. New equipment has been ordered and will arrive in Los Angeles within thirty days, so that the present output can be doubled. Crude rubber from Sumatra and Brazil is purchased direct from the plantation growers by the Los Angeles company and is processed by methods that were especially developed to produce rubber of a toughness necessary for oil well service. When the new factory is completed, a battery of six rolling mills will be placed in service. New testing equipment is also being added to the laboratory facilities.

Machinery for the packing of protectors in special containers for overseas and tropic shipments is also being installed, and this is said to be the first time that a company preparing mechanical rubber has designed special facilities for packing and protecting the product during transportation and while in storage in countries where severe climatic conditions exist, according to Jack C. Ballagh.

The company not only manufactures protectors, but a line of slush pump piston rubbers, valve rubbers and special moldings for blowout devices, etc.

Chain Belt Moves New York Office.

CHAIN BELT COMPANY of Milwaukee has moved its New York office into new and larger quarters. For a number of years their New York office was located at 50 Church Street. The new quarters are in the new Chrysler Building, 405 Lexington Ave., New York City. W. H. Quinn is New York district manager.

Metered Combustion Control.

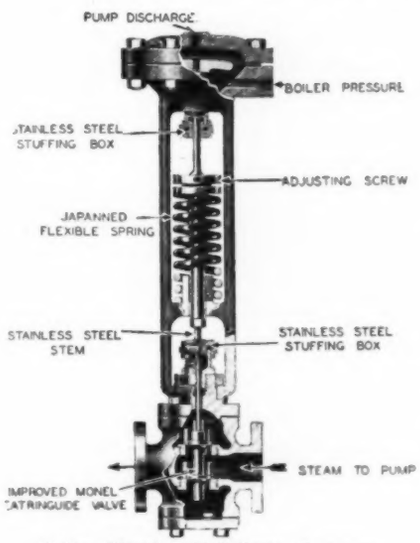
METERED Combustion Control for boiler furnaces (Gibson System), or bulletin No. 660, has just been issued by the Leeds & Northrup Co., of Philadelphia. It is a 32-page illustrated booklet, describing principle of L. & N. metered control, control of stoker fired furnaces, and control of powdered fuel furnaces.

Baldwin and Duckworth Companies Merge.

THE merger of the Baldwin Chain & Manufacturing Company of Worcester, Mass., and the Duckworth Chain & Manufacturing Company of Springfield, Mass., has been announced. The merged company will be known as the Baldwin-Duckworth Chain Corporation.

The new corporation will operate the present factories in Worcester and Springfield as separate divisions with administrative headquarters in Springfield, Mass. The officers are: President, George H. Empsall, of Springfield; vice-presidents, Frank J. Weschler of Worcester, William E. Gilbert of Springfield and W. F. Cole of Worcester; Treasurer, Mr. Weschler. George D. Gilbert has been appointed sales manager of the Duckworth Division and Arthur W. Warren sales manager of the Baldwin Division.

Neilan Marketing New Pump Governor



Neilan "Seatringuide" Pump Governor

ANOTHER member of the new Neilan line of automatic control and regulating devices has been put on the market by Neilan, Schumacher & Co., Los Angeles. The illustration shows the advanced Neilan Excess Pressure Pump Governor. It is fitted with the improved "Seatringuide" valve in which the valve plug and seat rings are milled from Monel metal. This type of valve, by eliminating flow turbulence common in wing guided valves, greatly reduces wire drawing. Neilan governors are made of bronze, cast nickel-iron and chrome-alloy cast steel for pump discharge pressures up to 600 pounds. In the new Neilan line is found the results of several years of research and manufacture of sensitive control devices for the oil and gas industries.

$3,000,000 Merger of Prominent Oil Tool Companies

FORMATION of the Globe Oil Tools Company, a new $3,000,000 California holding corporation, has just been effected through a consolidation of three prominent oil tool manufacturing concerns on the Pacific Coast.

The merged companies are the H. C. Smith Manufacturing Company, of Los Nietos; the Weiman-Kammerer-Wright Company, Inc., of Hollydale; and the National Tool & Metals, Inc., of Torrance.

According to J. C. Wright, president and general manager of the new concern, all outstanding stocks of the constituent companies will be held by the new holding company and eventually retired. It is proposed, Mr. Wright said, to eventually locate all three concerns at Los Nietos, California, on the property now occupied by the new modern plant recently constructed by the H. C. Smith Manufacturing Company.

The Globe Oil Tools Company has an authorized capital of 500,000 shares of no par value, and on the basis of the exchange of stock by which the consolidation has been effected, the stock has an indicated value of $10 a share.

The H. C. Smith Manufacturing Company is the oldest and largest unit in the present merger, having been organized more than eight years ago and since developed to approximately a $1,500,000 company. Weiman-Kammerer-Wright Company was organized in 1926 and has grown into practically a $1,000,000 concern. National Tool & Metals, Inc., began operations more than a year ago with a capital of $500,000.

The officers of the new organization include: President and general manager, J. C. Wright, formerly president and general manager of the Weiman-Kammerer-Wright Company; vice-president and general sales manager, M. G. Brumley, formerly vice-president and general manager of National Tool & Metals, Inc.; vice-president and assistant sales manager, Edgar H. Wilson, formerly vice-president and sales manager of Weiman-Kammerer-Wright Company; and secretary-treasurer, J. S. A. Smith, secretary-treasurer of the Emsco Derrick & Equipment Company. The Board of Directors, in addition to the above-named officers, include: H. C. Smith, president of the H. C. Smith Manufacturing Company; E. M. Smith, president of Emsco Derrick and affiliated companies; and W. A. Trout, vice-president and general manager of the Emsco Derrick & Equipment Company.

The management plans, by this merger, to effect greater economies in the manufacturing and distribution of all of their products. The new company will have a complete line of drilling tools, including as their major items six types of rotary drilling bits, four types of coring equipment, various types of straight reamers and under-reamers, and in addition a number of specialties such as safety brake attachments, float valves and eccentric straps, wire line control, drilling pipe guides and tubing swabs. Also, the acquisition of the National Tool & Metals, Inc., will bring into the new concern a complete line of diamond-sub insert metals, hard facing, welding rods, pump pistons, casing protectors, and general electric and acetylene welding supplies.

In addition to California, all three constituent companies are operating in the Mid-continent oil fields at the present time, from their branch at Oklahoma City, Okla.

M. G. Brumley, vice-president and general manager

J. C. Wright, president and general manager

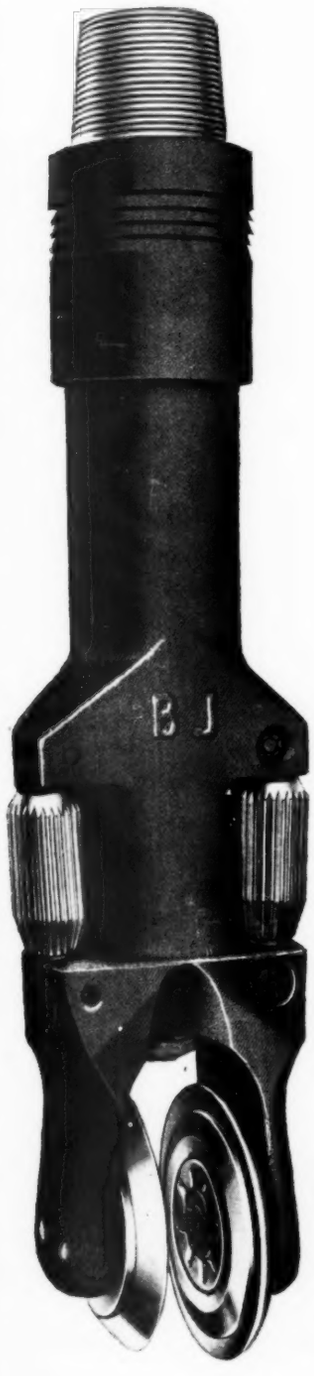
Edgar H. Wilson, vice-president and assistant sales manager

PLANTS IN MERGER OF GLOBE OIL TOOLS CO., AND OFFICERS OF COMPANY.

Gravity of Petroleum Oils.

"THE Practical Method of Reducing Observed Degrees A. P. I. to Degrees A. P. I. at 60 Degrees F." is a new handy booklet of tables prepared to give a shorter method for arriving at corrected gravity results of crude oil. The tables are based on data of the Bureau of Standards and the American Petroleum Institute. The book has been compiled and published by J. J Stephens, 318 Roosevelt st., Sand Springs, Okla. Stephens is with the Sun Company.

The Hole Story



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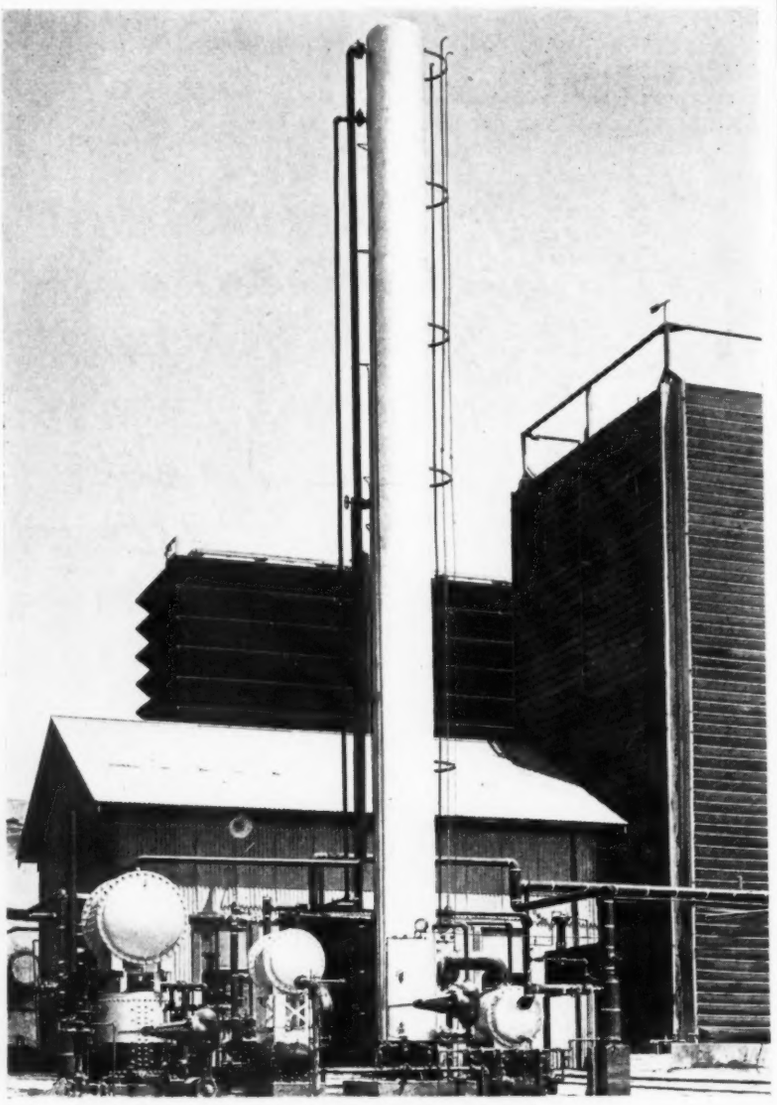
Getting Results from Field Organizations

By C. L. HIGHTOWER[1]

WE are today but a few years removed from the master-and-apprentice era in industry. The problem of personnel management and control under the master-and-apprentice regime was comparatively simple. The master mechanic had immediate supervision over one or two apprentices and the employer had a close contact with all employes, since business was done on a small scale and each establishment employed a limited number of workmen. In those days the employer, or the "big boss," as we are wont to say, had an opportunity to form a personal acquaintance with each man. He knew Bill's likes and dislikes. He was informed of his financial condition and knew whether or not the children had the measles. In fact, he knew as much about Bill as Bill's fellow worker knew, and to Bill the "boss" was just one of the boys. Under this arrangement of personnel control misunderstandings were few, and, production methods being less complicated than they are today, business as a whole ran along smoothly.



Distillation unit in a natural gasoline plant.

Then came the advent of big business, the machine age and mass production. And the employer who once knew all of his workmen by their first names found himself removed from this personal contact and with a personnel of hundreds and even thousands, whereas before it was only ten or twenty. Of course, it required considerable time for this advancement in American business, but the change took place over a few short years and without its being fully realized by industrial leaders.

These growing organizations demanded supervision both as to men and methods and, since the task was beyond the employer, business was segregated into departments and divisions and the positions of department head, superintendent and foreman were created. The supervisor of the particular department or crew then became, so far as the workmen were concerned, the company and the "boss." Upon the shoulders of this supervisor fell the responsibilities of making personal contact, building morale, perfecting methods and training workmen. These same responsibilities exist today, only they are greater. The demands of a supervisor are greater than the mere overseeing of work. He must be a leader of the highest type, capable of inspiring confidence, developing loyalty, perfecting methods, and the ability to bring out the best there is in a man. The supervisory force of any organization is the backbone of that organization and either makes or breaks it.

With mass production and machines our accident frequency increased. Business was speeded up and the man was taken from the work bench and his hand tools, and assigned to the operation of complicated machinery. Guards were installed, machines improved, and yet we had broken and crushed workers. It is true that these accidents were occurring in connection with machines, but the machines were not responsible—rather, we had not progressed as fast in training men as we had in building machines. It was only after we turned our attention to educating and training our men that any appreciable reduction in accidents was noticeable, but even today we

[1] Texas Pacific Coal and Oil Company, Thurber, Texas.

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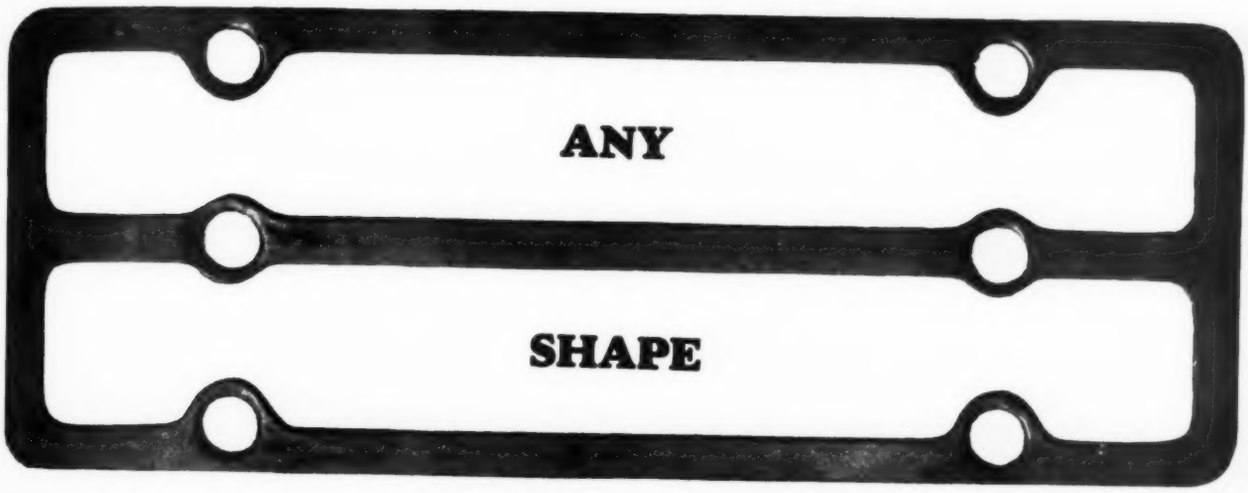

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are still far behind. Our workmen are not developed and trained to the extent that our machines are perfected.

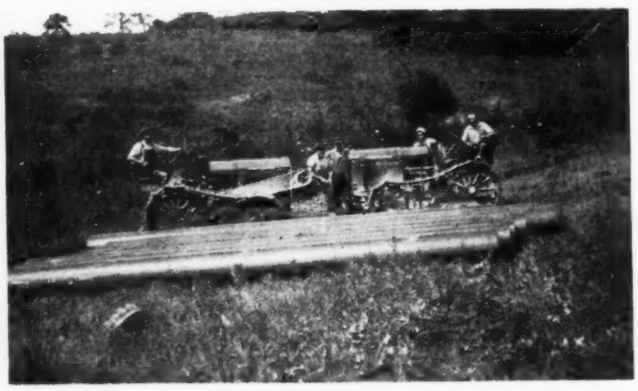
In considering, then, the question of "getting results" from accident prevention effort, I think this thought should be foremost: "We must better train and develop the individual workmen."

Conditions vary, of course, in each organization, and a plan that is suitable for one company may not be practical for another. There are, though, certain fundamental practices that can be followed by any supervisor in any organization with good results.

Each job has its particular requirements and we should know what the demands are on the man; what physical, mental or temperamental qualifications he must have to properly discharge his duties. A man physically, mentally and temperamentally suited for a pumper might not be so suited for a truck driver or a plant operator. Do you consider this in hiring a man? Or have you been trying to fit round pegs into square holes?

Arkansas Natural Gas Co. gasoline plant in the Smackover field, Arkansas.

This is the first and most important question, both from an accident prevention and general efficiency standpoint, and, since the estimated cost of employing the average workman and getting him placed on the job is $200.00, is it not worth your time and trouble to question the prospective employe and investigate his qualifications? When you buy wire rope, pumping engines or compressor units, don't you demand certain specifications? Then, isn't the man who is to use, operate and maintain this equipment equally as important? Spend a little more time in hiring a man and get the right man for the right place.



Stringing pipe for a gas line with tractors.

You know, they say the easiest way to teach a boy to swim is to throw him in where he either has to swim or drown. Some supervisors use the same method in placing men in their organization. They are thrown into the work and it's up to the man to make good, or else—else what? Else damage equipment, injure himself or the other fellow and cause disruption in general. It may be a good plan in the mind of some, but we can't get away from the fact that it is a costly one. How much better it would be to take the new man out to his job—it matters not whether he has drilled all of his life or operated a gasoline plant since he was a kid—and introduce him to the men he is to work with, tell him of the known dangers of the work. It only takes a little time and one string of tools, one compressor or one life will pay for the cost of introducing hundreds of men.

Lining up large-diameter gas pipe with tractors.

It doesn't matter what you are hiring a man to do; if he is just going to dig a ditch, it will pay you to take the time to tell him how to hold a shovel or a pick, how to shore a ditch and the distance he should maintain from the other fellow.

You wouldn't install an engine with any hope of it operating without putting in a good substantial base. Then, why not give the employe a firm footing to start with? Give him an even break.

The most difficult and yet the most important thing required of a supervisor is to develop and maintain morale—keeping the worker satisfied, loyal and intently interested in his job. I have heard some supervisors say "Oh, well, I can't keep the men satisfied, because I can't pay them enough money." Men have to live, but they don't work for money alone. A small percentage of labor turnover is due to workmen seeking bigger wages. A man will stay on a job where his surroundings are pleasant and agreeable and he likes his "boss" for a lot less money than he can get elsewhere. I grant that it's no easy task. It's another supervisory responsibility that requires the highest type of leadership. The relationship of loyalty, good feelings, etc., to the accident rate is so well known that it's hardly worth mentioning. They have accidents where unhealthy employe relations exist, and they do not have them where such conditions do not exist.

We have recently come to know of the no-injury accident. That is, an accident happens maybe many, many times before someone is hurt. Maybe a board or wrench falls from the tubing board ten times without striking anyone. Every time it falls an accident occurs and it is but good fortune that no one is injured. What is our usual attitude toward such an experience? We shake hands with ourself and say "My, we were lucky nobody was hurt there." But do we accept the warning and stop the practice of leaving loose boards or wrenches on the tubing board? No, we do not, and the practice is continued until someone is hurt. You may feel that you have done your duty when you tell the workmen to discontinue such a practice, but you have not. It's up to the gang pusher or other individual in charge to watch for such unsafe practices and stop them before an accident occurs. Closer supervision in these matters is an investment which will pay dividends.

Blowouts Can't Happen

« « if your wells are equipped with C-I-W Steam Operated Blowout Preventers « «

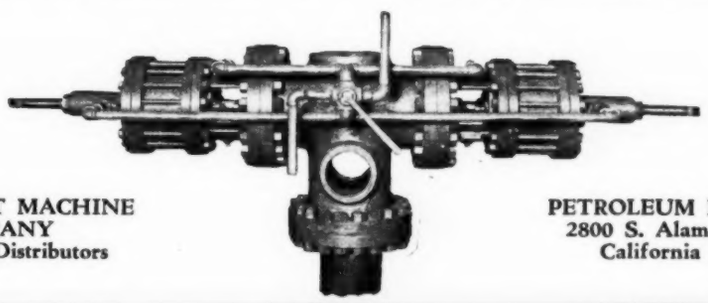
INSTANTANEOUS and Positive is the action of the C-I-W Steam Operated Blowout Preventer.

Instantaneous...

With the speed of lightning, the Preventer closes. A quarter turn of the 4-way operating valve allows steam or other pressures used to enter the cylinders and drive the solid steel rams around the drill stem. This operating valve is located at a safe and convenient distance from the well so that the Preventer can be closed without endangering the lives of workmen. This is an exclusive C-I-W Blowout Preventer feature.

Positive...

Because its grip is steel against steel, and because couplings or tool joints cannot pass through the thick walls of solid steel formed by the closed rams, the drill stem cannot be blown out of the hole. Weight of drill pipe is NOT a factor in this Preventer's operation. If only one length of pipe were left in the hole a complete shut-off is assured. The specially designed packing that packs tighter as the pressure increases forms a perfect gas and fluid tight seal around the rams and drill stem. ... Because every Preventer is guaranteed and tested in our own plant to withstand 3000 pounds pressure per square in., and because not one has ever failed to hold, we say BLOWOUTS CAN'T HAPPEN, if your wells are equipped with C-I-W Steam Operated Blowout Preventers.



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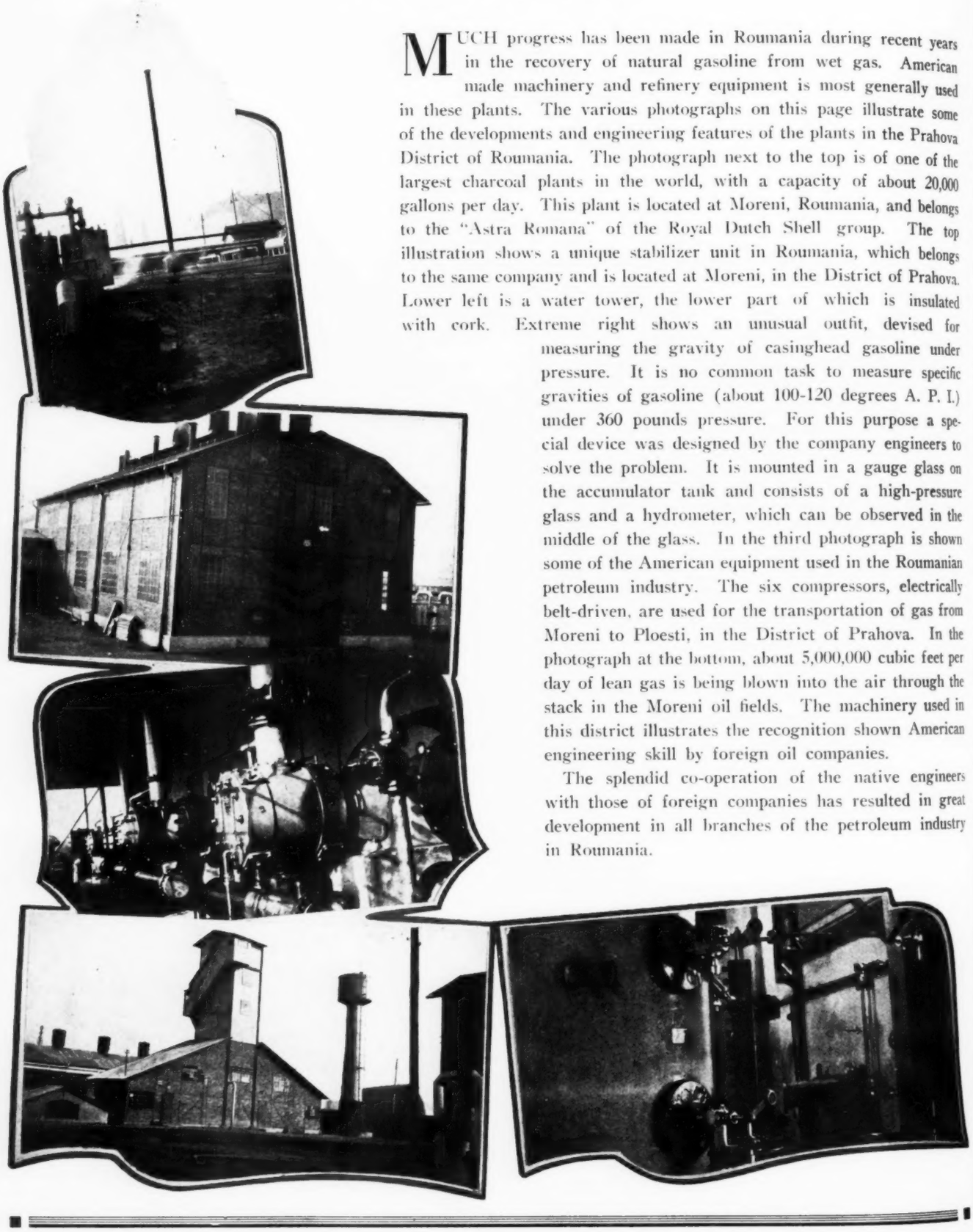
Much Progress Shown in

Gasoline Manufacture *in* Roumania

By **M. FRENC,** ***Chemical Engineer***



MUCH progress has been made in Roumania during recent years in the recovery of natural gasoline from wet gas. American made machinery and refinery equipment is most generally used in these plants. The various photographs on this page illustrate some of the developments and engineering features of the plants in the Prahova District of Roumania. The photograph next to the top is of one of the largest charcoal plants in the world, with a capacity of about 20,000 gallons per day. This plant is located at Moreni, Roumania, and belongs to the "Astra Romana" of the Royal Dutch Shell group. The top illustration shows a unique stabilizer unit in Roumania, which belongs to the same company and is located at Moreni, in the District of Prahova. Lower left is a water tower, the lower part of which is insulated with cork. Extreme right shows an unusual outfit, devised for measuring the gravity of casinghead gasoline under pressure. It is no common task to measure specific gravities of gasoline (about 100-120 degrees A. P. I.) under 360 pounds pressure. For this purpose a special device was designed by the company engineers to solve the problem. It is mounted in a gauge glass on the accumulator tank and consists of a high-pressure glass and a hydrometer, which can be observed in the middle of the glass. In the third photograph is shown some of the American equipment used in the Roumanian petroleum industry. The six compressors, electrically belt-driven, are used for the transportation of gas from Moreni to Ploesti, in the District of Prahova. In the photograph at the bottom, about 5,000,000 cubic feet per day of lean gas is being blown into the air through the stack in the Moreni oil fields. The machinery used in this district illustrates the recognition shown American engineering skill by foreign oil companies.

The splendid co-operation of the native engineers with those of foreign companies has resulted in great development in all branches of the petroleum industry in Roumania.

Is a Cog missing in your Organization?

Frequently a threatening gap appears in the Organization of a gas or petroleum company. Incomplete engineering resources to see a job through from start to finish makes evident the need of outside assistance. Whealton & Townsend service will take up the burden anywhere along the line —preferably at the start of the project—and guarantee completion at a specified date and at a specified cost.

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Right-of-Way PROBLEMS « «

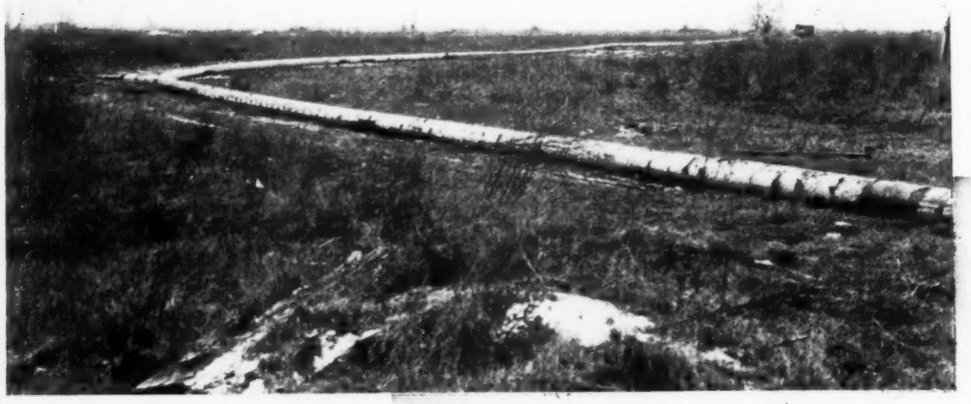
Cause *of* Sharp Pipe Line Bends

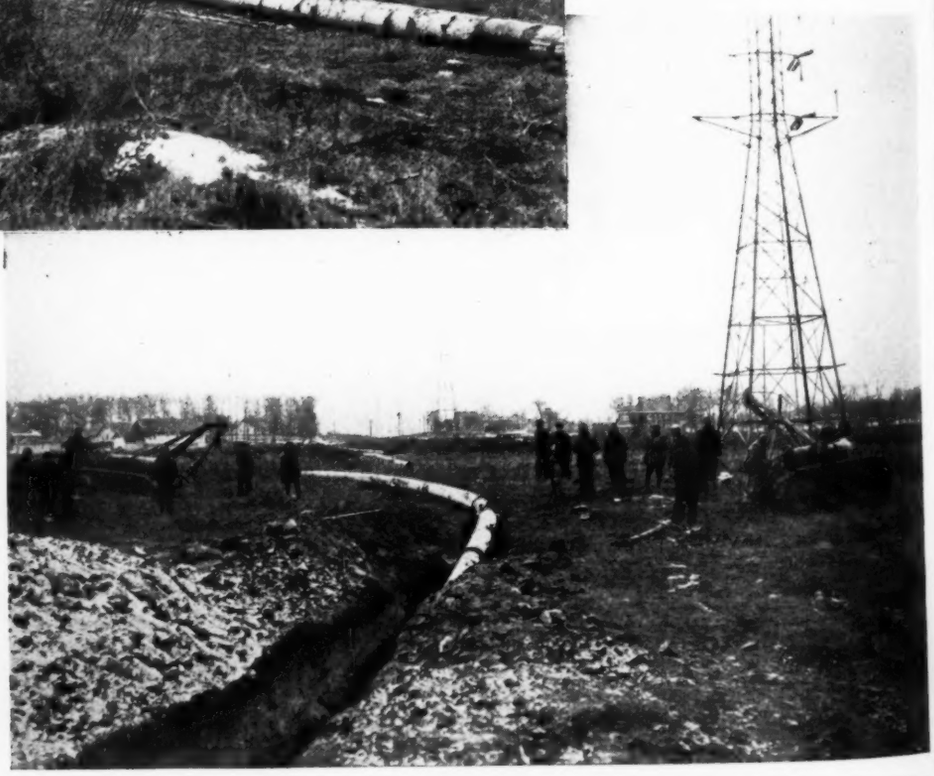
WHEN the Texas-Empire Pipe Line Co. built its 12-inch welded oil line from the Mid-Continent to serve refineries in the Chicago, Ill., territory, some right-of-way problems that required many sharp bends in the line were encountered. Entering the congested areas it was found impracticable to follow a route approximately straight to the terminus of the carrier.

About the only practicable solution to the problem was to follow the right-of-way of a power company's high line. This frequently called for a sharp bend where the high line made sharp turns. And, in order to follow the high line the power company required the line to be buried a certain distance away from its towers so, if in the future, another string of towers were built they would not be over the line.

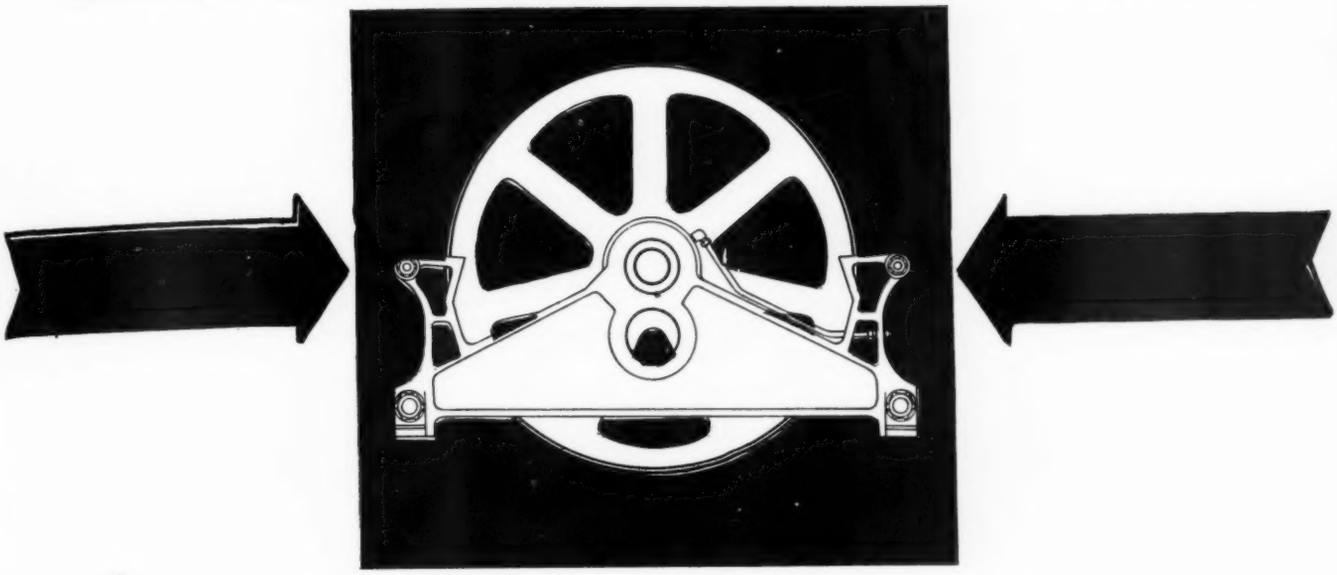
One of the accompanying photographs shows one of the several cold bends made. In order to keep the required distance from the towers a 90-degree bend was made. In the right-hand corner of one photograph is shown the leg of one of the towers and the cross arms of a few others. The other photo shows the construction crews making a 60-degree bend with tractors. The right-hand tractor holds a tight line on the pipe and the tractor, on the left, is anchored and does the pulling.

In staking the line engineers drove stakes to indicate the points where bends were to be made and the bends were made at that point regardless of any conditions.

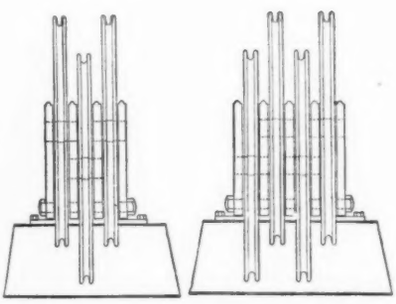




WHEN YOU NEED 10 LINES



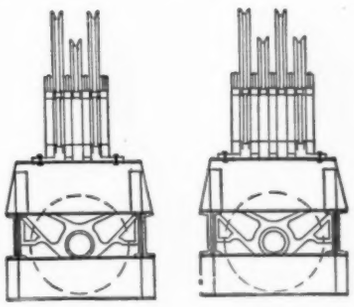
SIMPLE TO CONVERT REGAN CROWN BLOCKS



Type A upper sheave assembly, showing 3 sheaves and another added, converting a 7-sheave Block into an 8-sheave.

It's safer to use 10-lines in deep drilling fields. If you are using Regan Crown Blocks you can convert into 10 lines without costly changes simply by adding another beam and sheave. Installation can be made at the top of the derrick. The 7-sheave Type A Block can be converted into an 8-sheave. The 5-sheave Type B Block can be converted into a 6-sheave.

New Bulletins describing both Blocks now ready for distribution.



Type B upper sheave assembly, showing 3 sheaves and another added, converting a 5-sheave Block into an 6-sheave.

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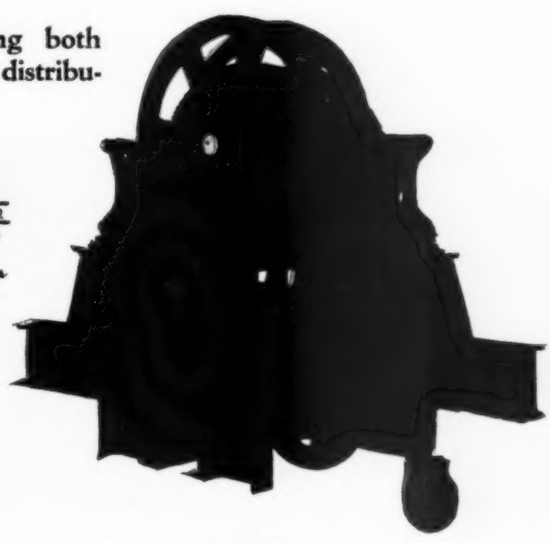


When writing REGAN FORGE & ENGINEERING CO. *please mention The Petroleum Engineer*

Simple Method Most Effective in

Controlling Flowing Salt Water Well

THE saying, "There is nothing new under the sun," applies to the oil business as well as to other lines of industry. While it is true that new discoveries and improvements are constantly being made, it is also true that the principle upon which they depend has been generally known for a long time. Recently an operator was confronted with the problem of controlling a well which was flowing salt water. It was necessary to do so with the least possible delay, as the lease date expired in a few days unless commercial production was obtained; also, a comparatively inexpensive method would have to be used, because the prospects for a well did not justify any considerable expenditure. Proper protection of an upper gas sand was also necessary, as its productivity was not fully known further than that it appeared other wells would be drilled to produce gas from this upper sand.

While drilling with cable tools to test an oil horizon at approximately 2200 feet, an unexpected gas sand was encountered at 1300 feet, producing about two million cubic feet of gas per day. As there was no immediate sale for the gas, drilling was continued and a hole full of water was found 100 feet lower. The 6-inch casing was landed through the water sand and was mudded to protect the gas sand from flooding. A few days later the gas pressure became great enough to blow out the mud behind the 6-inch casing and the well started flowing salt water from the lower horizon, as shown in the accompanying photograph (Fig. 1). After considering several plans, one of which was cementing the 6-inch casing under pressure, the operators decided to place mud behind the 6-inch and 8-inch casings to prevent another blowout.

Approximately 500 feet of well-selected shale mud fluid was placed in the bottom of the hole, and the remainder of the hole inside of the 6-inch casing filled with water. Gas clamps as shown in Fig. 2 were then obtained, which would effectively pack off the annular space at the surface between the 6-inch and 8-inch casings. The 6-inch casing was then lifted about 10 feet and was moved up and down while the mud was circulating behind the casing. Frequent tests were made to determine when a static level had been reached between mud on the outside of the casing and the mud and water inside the casing. One of the most simple methods of determining when circulation has ceased is to drop a chunk of mud down the casing, counting until it strikes the fluid. The only requirement for accuracy in this case is to count at the same rate each time. To observe full precaution it is advisable to rest the casing on bottom while testing the level of the fluid. If for any reason the casing should freeze, it will then be in a position where the least harm will be done. After circulation had ceased, the 6-inch casing was lowered to rest on the gas clamps and a bailer run to determine the amount of fluid displaced. This proved to be 300 feet, indicating that a column of mud approximately 800 feet high had been forced behind the 6-inch casing. Water from the salt water sand, forced up ahead of the mud, and fresh water, introduced through the 2-inch pipe opening in the gas clamps, filled the remaining 650 feet. By closing the openings in the gas clamps, further trouble from a blowout was eliminated. The stray gas sand was satisfactorily protected with a column of mud extending 600 feet above it. The total time consumed in the mudding operation, including the time spent in bailing the hole dry, was one hour. The total cost of this operation, including labor and material, was $75.00. Drilling was resumed as soon as the hole was bailed dry.

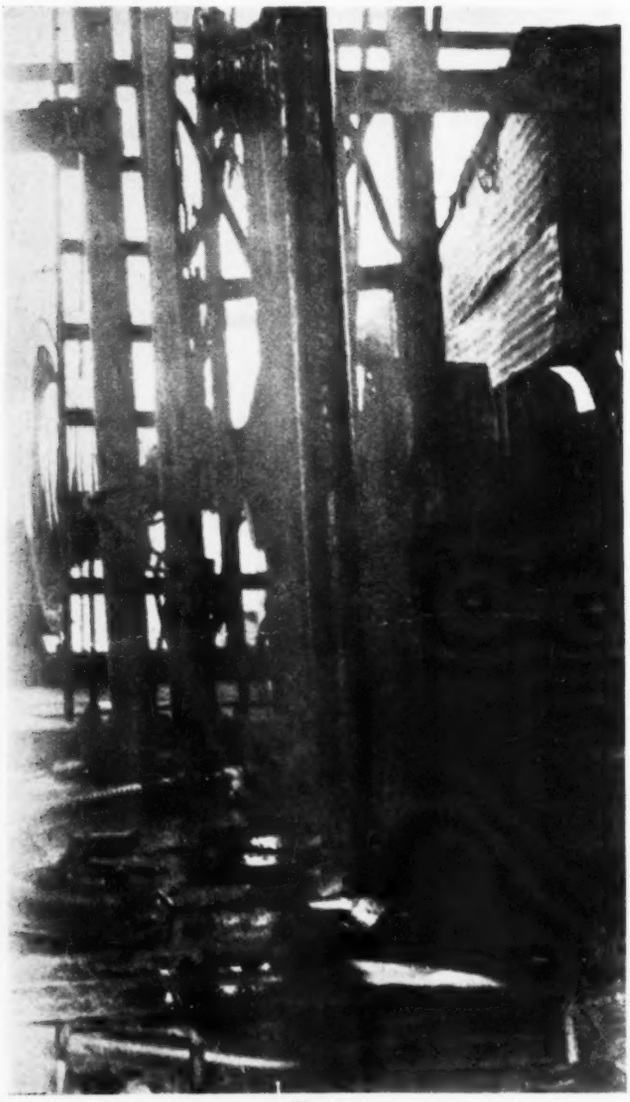


Fig. 1
Well flowing salt water and gas outside 6-inch casing.

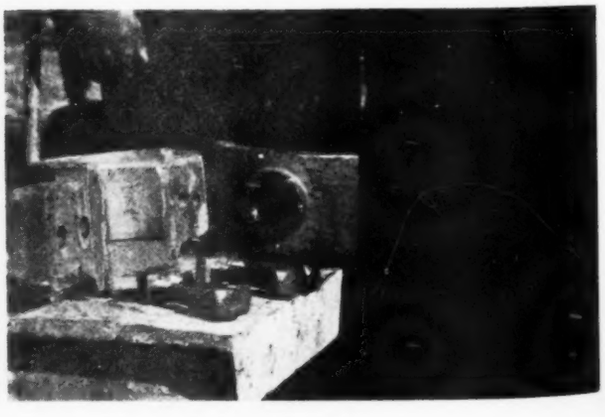
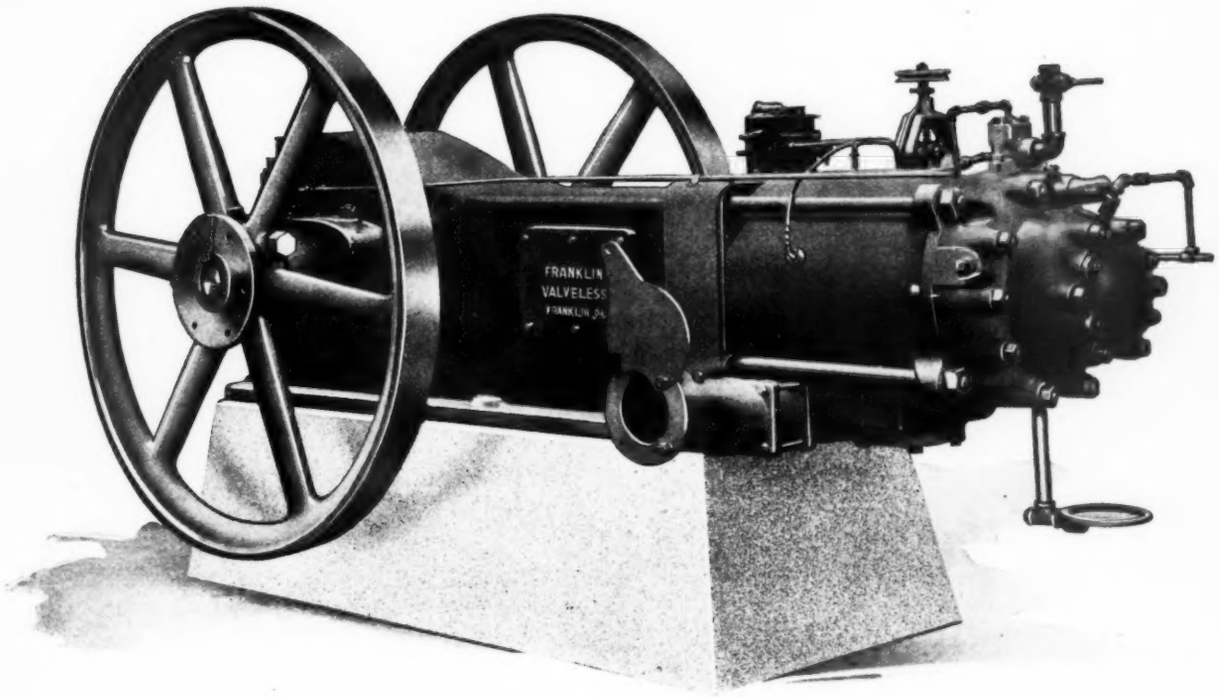


Fig. 2
Gas clamps used to pack off the space between 6-inch and 8-inch casings.



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This report was made by an unbiased investigator—it deserves the serious consideration of everyone interested in cable tool drilling. And the statement speaks volumes that substantiates our claims for this simple, strong engine with its wealth of reserve power and its famous fuel, lubrication and water economy.

Why not put the O.F. on your payroll?

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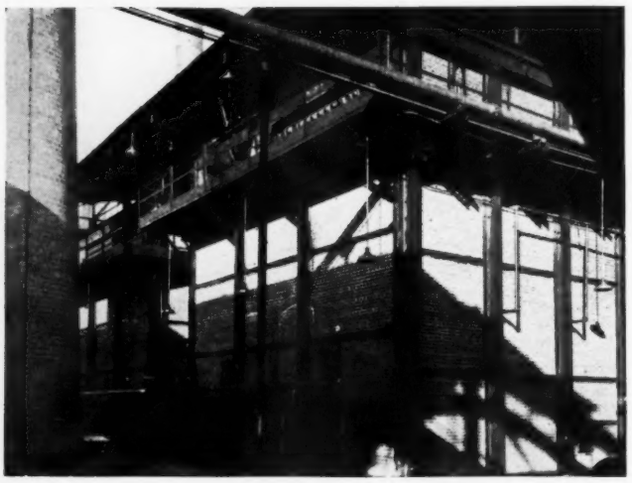
Two Stage Distillation Units for Lubricating Oils

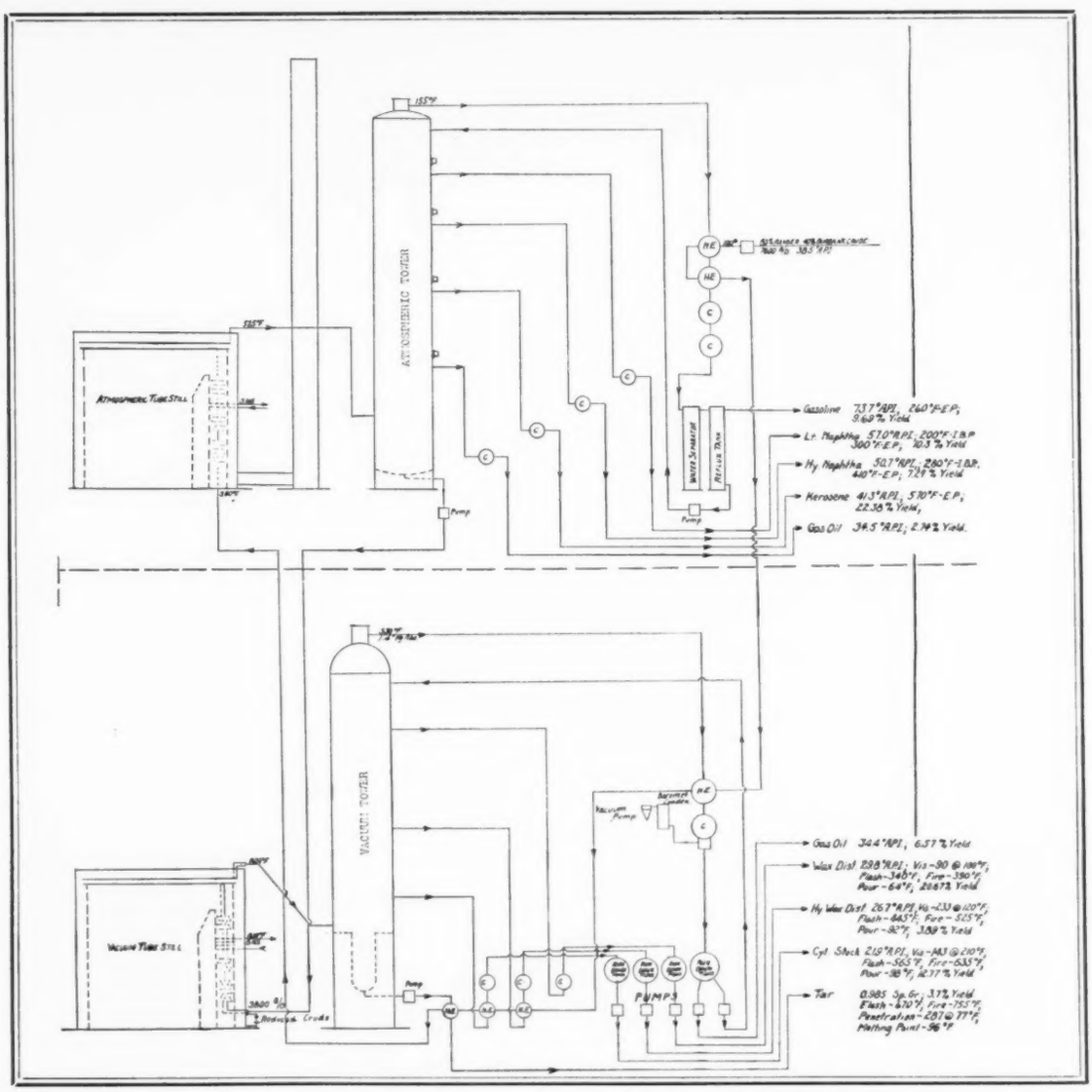


A 7,500-barrel vacuum atmospheric unit is operating on paraffine base Mid-Continent crudes by an eastern refinery. The flow sheet shows the operating temperatures, yields, and tests on products. The crude, after passing through the heat exchangers, enters the still at 400 degrees F. and leaves at 550 degrees F., vaporizing 50 per cent of the oil. Five streams are taken from the atmospheric tower and residuum goes to the vacuum tower. The tests on the various streams are shown on the flow sheet. In the vacuum stage tubes the residuum is heated to 800 degrees F. and all but 3 per cent of the charge is vaporized. Four streams are taken from the vacuum tower and a tar bottom.

The overhead stream from the vacuum tower is heavy gas oil, and two streams of wax distillate are taken off the side, pressable and heavy wax distillate. An overhead stock of high flash and fire test is taken off the side also.

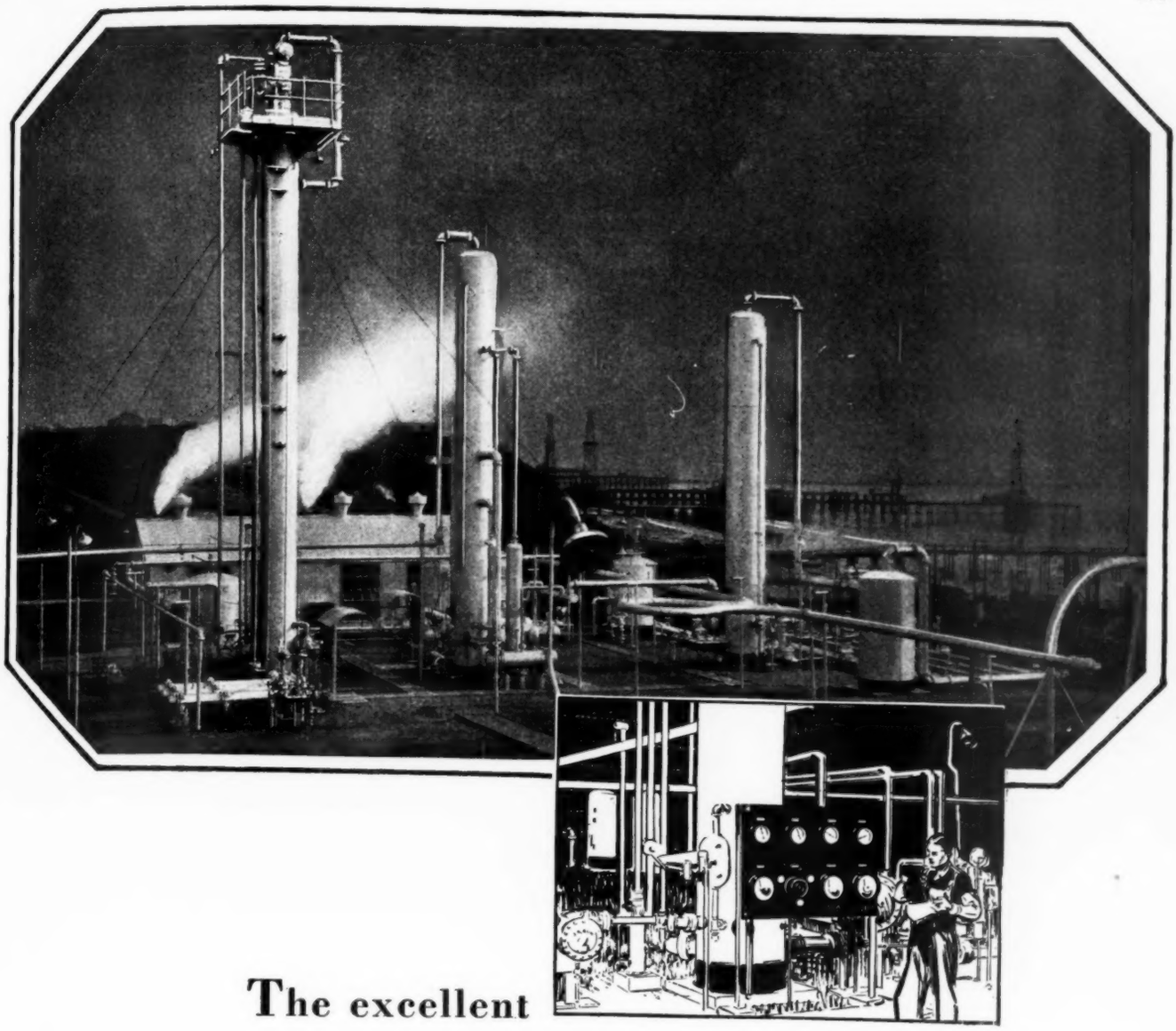
The atmospheric tower is 9 feet 9 inches in diameter and 90 feet high. The vacuum tower is 15 feet in diameter and 100 feet high.

During the past year many refiners have come to the conclusion that lubricating oils, for the internal combustion engine, produced from overhead stocks for distillates, are superior to residual oils. These oils usually have a lower carbon residue and higher flash and fire test. In general they have lighter colors than the usual dark green motor oil produced by blending residual stocks, due to the better fractionation in properly designed equipment.


ATMOSPHERIC TOWER
VACUUM TOWER
Gasoline 73.7°API, 260°F-E.P., 9.69% Yield
Lt. Naphtha 57.0°API, 200°F-I.B.P. 300°F-E.P., 10.3% Yield
Hy. Naphtha 50.7°API, 280°F-I.B.P. 410°F-E.P., 7.29% Yield
Kerosene 41.3°API, 370°F-E.P., 22.36% Yield,
Gas Oil 34.5°API, 2.74% Yield.
Gas Oil 34.4°API, 6.57% Yield
Wax Dist 29.8°API; Vis-90 @ 100°F, Flash-348°F, Fire-390°F, Pour-64°F, 26.87% Yield
Hy Wax Dist 26.7°API, Vis-230 @ 100°F, Flash-443°F, Fire-525°F, Pour-82°F, 3.89% Yield
Cyl Stock 21.9°API, Vis-443 @ 210°F, Flash-565°F, Fire-635°F, Pour-98°F, 12.37% Yield
Tar 0.985 Sp. Gr.; 3.7% Yield Flash-600°F, Fire-755°F, Penetration-287 @ 77°F, Melting Point-96°F
PUMPS

At left, above — Pipe still for lubricating oil.

Below—Flow sheet of a two-stage distillation unit. (Courtesy Foster Wheeler Corp.)



The excellent operation of this BRAUN absorption plant is as gratifying to its owners as it is to ourselves. It is now operating at a load considerably in excess of its quoted performance. The capacity is being doubled by the addition of a duplicate distillation unit.

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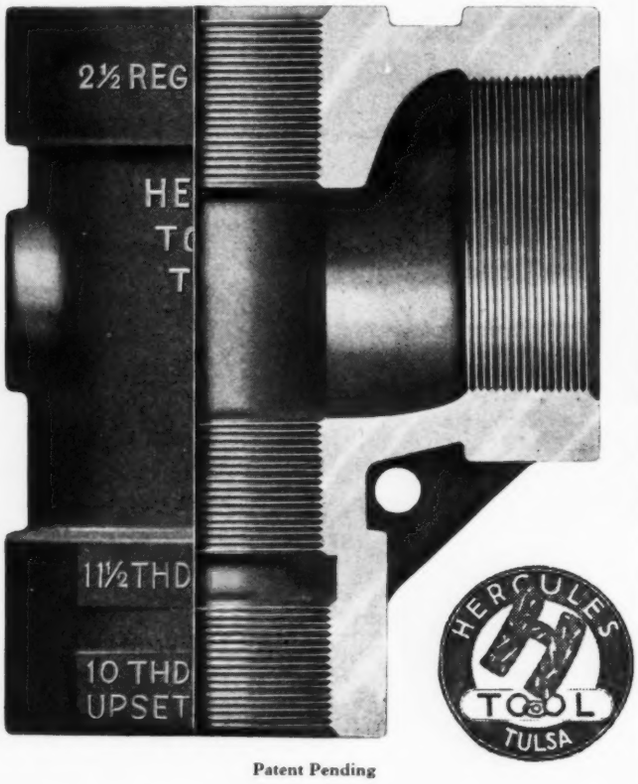
"Just what we have needed"

—is what they are saying in the field about this NEW HERCULES UPSET PUMPING AND FLOWING TEE, that has proven to be such a time and trouble saver when wells are connected.

Here we have a combination *pumping* and *flowing* tee, made with both *regular* and *upset* threads on the bottom. No cutting off of the upset end of tubing at the top of the well is necessary—and you do not have to use swage nipples to reduce from the upset to regular threads.



Patent Pending

Each Tee has a regular thread on top, a 90-degree side outlet for lead, or flow, line (all 2½" Tees have a 3" side outlet—as illustrated). On the back side there is a one-inch opening for a bleeder valve, or for connecting a pressure gauge if used on air lift. This new Tee is tested for 3,000 pounds pressure.

Write for detailed descriptive pamphlet

Hercules Tees now on sale by all leading supply houses.

HERCULES TOOL COMPANY

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Phone 3-2358 **Palace Bldg.**

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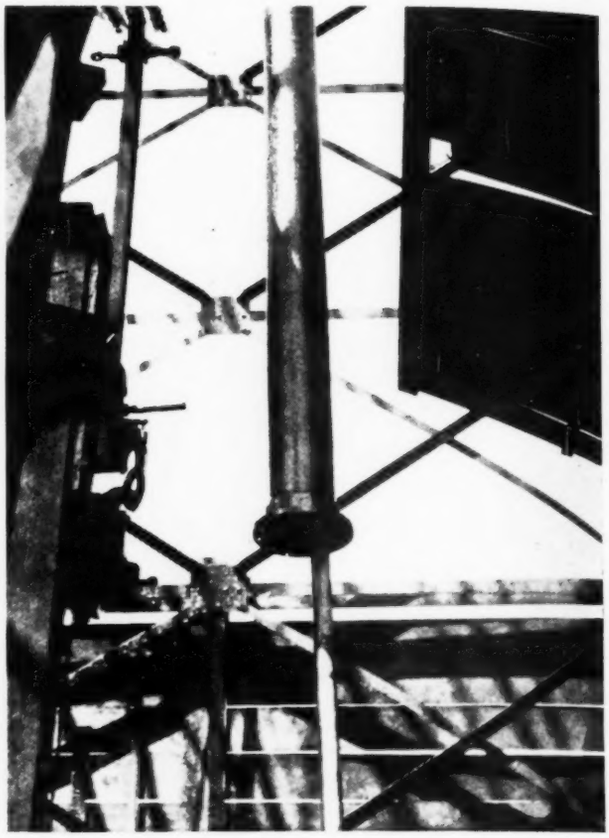
Lubricator Employed to Aid Standard Tools

THE use of five joints of casing with a lubricator, similar to an oil-saver, screwed in the top joint has enabled the Sinclair Oil & Gas Company to use standard tools on its School Land 1, in the Oklahoma City field.



Picture of lower end of lubricator as it hangs up in the rig.

This lubricator prevents the high pressure in the hole from blowing out the tools when lowering or bringing them from the hole, and also in saving much oil at this point of the operation.

The lubricator is flanged at the bottom to fit the casing and bolted down when bringing out or lowering the tools into the hole. The standard cable runs up through the lubricator. When running the bit into the hole the tool is drawn up in the joints of casing, which is then lowered over the casinghead and bolted down. The gate is then opened and the tools lowered into the hole. The same method is used when bringing the tools out of the hole.

This well was drilled into the producing horizon with the usual methods employed at Oklahoma City—that is, with a rotary—but since this time it has been drilled deeper with standard tools. This is the only string of standard tools in use in the field at this time.

New Books for Oil Libraries

"What is Petroleum?" has been published by the American Petroleum Institute to provide the student and layman with an idea of the origin, nature and characteristics of petroleum. Available from American Petroleum Institute, Department of Public Relations, 250 Park Ave., New York.

ℰ ℰ ℰ

"Handbuch der Internationalen Petroleum-Industrie" is a reference work on companies engaged in the oil industry throughout the world. It is compiled by Dr. Oskar Tokayer and published by Finanz-Verlag, 47 Neue Friedrichstrasse, Berlin, C.2, Germany.

When writing HERCULES TOOL COMPANY *please mention The Petroleum Engineer*

ELECTRICALLY driven compressors offer DEFINITE advantages in the operation of ..... AIR-GAS LIFT Plants

A comparison of operating costs and efficiency between electrically-driven compressors and those using other types of power reveals many interesting and convincing facts, all decidedly in favor of electricity. The complete survey taken from actual operating conditions is available through our commercial department to all air-gas plant operators who are interested in decreasing operating costs and increasing operating efficiency through electricity's

1. Smallest fire cost.
2. Lowest installation cost.
3. Minimum of labor required for attendance.
4. Portability.
5. Extreme flexibility in station capacity.
6. Large salvage value of electric equipment.
7. Minimum maintenance.
8. Uniform speed.

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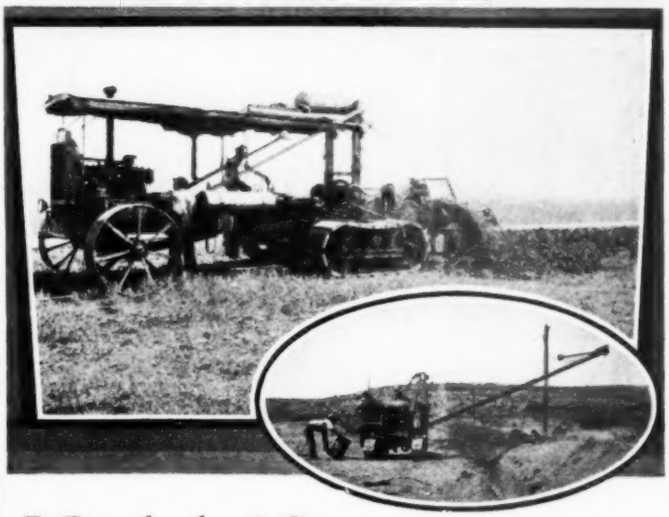
PUBLIC SERVICE BUILDING . . TULSA

Speed, Low Maintenance and Mobility — THAT'S BUCKEYE!



Model 32 *Wheel-Type* Ditcher

A ruggedly built ditcher is Model 32 — and adapted particularly to cross-country work under every practical condition for pipe line construction. Its general design appeals strongly to those favoring transmission controls.

Chief of its preferred operating features are: Practically *all-transmission* control; rigid digging wheel, grading accurately and driven from both sides to equalize pull; 16 digging speeds, ranging from 18 inches to 19 feet per minute; power steering; 71 h. p. heavy-duty Waukesha motor; Alligator (crawler) wheels with traction brakes for safe operation on grades; 15½ to 30-inch cutting widths; and 6½-foot cutting depth. Many others.

Write for Model 32 complete specifications and price.

Model F *Service* Backfiller

This little Buckeye offers remarkable economy in refilling both small main and service trenches. Measuring only 69 inches overall in width (without boom), 7 feet 6 inches in height and weighing but 4 tons; it is easily and quickly maneuvered in close quarters or transported from one job to another. "Back-action" scraper permits operating from the spoil-bank side of the trench. Traction brakes allow safe operation on grades. Ask for Model F price and specifications — both will interest you.

The Buckeye Traction Ditcher Co.
FINDLAY, OHIO

There's a Buckeye Sales and Service Office Near You

for over thirty years Buckeye

502,000 BARRELS OF OIL

Thru 1 Joint

of THE LAYNE

MILLED GROOVE SCREEN

This remarkable production performance was established by the Kirby A-8 well at Barbers Hill, Texas. The well came in January 4, and through March 30 it had produced 502,000 barrels of oil through one joint of the Layne Keystone wire-wrapped *Milled Groove* Screen—oil industry's latest and most important invention.

The exclusive and sensational *Layne Milled Groove* Screen, the culmination of a quarter century's experience and development, does not clog with mud and sand, eliminates "sand-cutting," is a tonic to low pressure wells and is a cushion against "cutting" high pressure.

Install the *Layne Milled Groove* Screen instead of wishing you had!

•

Write, wire or phone for further information, catalogue or quick service.

The Layne & Bowler Co.

HOUSTON, TEXAS

The Layne New York Co. 30 Church St., New York — The Layne & Bowler Corp. Los Angeles, Cal. — Vickers, Limited London, England

E. E. Le Masters Passes On

Funeral services for E. E. Le Masters, General Superintendent of the Oklahoma Pipe Line Co., were held from the Masonic temple at Muskogee, Okla., on Friday, May 2. Mr. Le Masters died at Battle Creek, Mich., from heart disease.

Mr. Le Masters, who had been associated with the pipe line company since 1909, was born August 20, 1872, at Morgantown, W. Va. He was the son of Mr. and Mrs. W. J. Le Masters, and of French descent. He entered the employ of the Standard Oil Company as a youth and after serving in the oil fields of Louisiana, removed to Oklahoma and became associated with the company in whose employ he died.

The Rev. W. H. Clark, Oklahoma City, and the Rev. C. E. McMoody, of Muskogee, had charge of the services. A Masonic ritual also was held. Burial was at Memorial Park, Muskogee.

He is survived by his widow and three sons, P. C. Le Masters of Peru, South America, and Jack and Morgan of the home address, and three brothers, Luther Le Masters of Bethseda, Ohio; P. G. Le Masters of Clarksburg, W. Va., and C. Le Masters of Oakland, Calif.

New Claimant for Deep Drilling Honors

LAURELS for the world's deepest well are now held by the Standard Oil Company's Mascot No. 1, a deep test drilling near Taft, California, which recently reached a depth of 9629 feet. The outlook for reaching the 10,000-foot mark appears favorable.

Besides holding this record, the well is believed to be the first wherein the rights to the oil and gas production below a certain level are held by one company and above this certain level by another company. The well was owned originally and drilled to a certain depth by the Mascot Oil Company without obtaining commercial production. It was then taken over by the Standard Oil Company, the Mascot Oil Company retaining the rights to any oil or gas production found in the upper part of the hole which it had drilled.

Now!

A complete all-steel RIG on a standard FORD TRUCK « « «

Position of rig when transporting from one location to another.

Built especially for shallow water wells and geological work. The entire rig consisting of derrick, rotary, draw-works, pump, swivel, drill stem, and all accessories is mounted complete on a model AA, 1½-ton standard Ford truck with four-speed transmission. Power for operating rig is obtained from truck motor and variable speeds and powers are attained through the standard transmission, plus motor acceleration. When collapsed to move from one location to another a driving speed of 35 m. p. h. is obtainable. The rig is all-steel construction. For complete specifications see opposite column.

Set-up position ready for drilling.

SPECIFICATIONS

POWER: Driving and transport power is derived from the Model AA Ford Truck on which it is mounted. Special sprockets attached to rear wheels of truck and driving to line shaft of rig through high speed roller chain drives from each wheel, transmit power of the engine through the standard transmission, thus giving a choice of four speeds forward and one reverse, plus the acceleration of the engine in each range. Control is by means of control rod to engine throttle from operator's position and control rod from operator's position to transmission of truck.

FRAME AND MAST ASSEMBLY: Frame and mast is of fabricated steel construction. The frame is mounted on chassis of truck and securely bolted by U bolts. Mast is hinge type construction, so that in transporting from one location to another the upper section with crown block built in may be folded back and the entire mast raised and bolted to A frame, built into the main frame of unit.

LINE SHAFT: 2 7/16" diameter is sufficient to transmit power at all speeds. It is mounted on main frame of unit in two all-steel bronze lined bearing boxes.

DRUM SHAFT ASSEMBLY: Drum Shaft is 3 7/16" diameter and is mounted in special bearings designed to accommodate the free floating drum employed in this unit. Power is transmitted from shaft to drum through block type friction clutch.

ROTARY: All-steel construction with ball-bearing raceways between table and base. It is especially designed to be mounted in base of mast on steel plate. Opening through table will permit the setting of 4½" casing and is machined to use 3" Kelly Drive Bushings or tubing slips for holding drill pipe. Power is transmitted from line shaft to rotary through short shaft mounted in steel bearing boxes with Alemite lubrication.

SWIVEL: Swivel is our own design, fully enclosed and ball-bearing type. It is all-steel construction and has provision for 2½" 8-thd connection to Kelly.

KELLY: Kelly is 3" square by 10 ft. long, with 1¼" water course. Bushings are provided in rotary for driving this Kelly.

SLUSH PUMP: The 4"x6" Gardner Enclosed Oil Bath Type Pump is mounted on sub-base provided in main frame and is driven by means of separate power take-off from engine in truck.

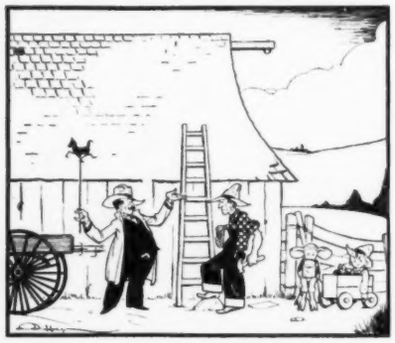
OPERATION: Mast may be lowered from its position on "A" Frame to foundation by means of small chain block. Upper section of mast is then raised to position by use of drum line after rig is running. Foundation for rig may be any height from ground operator desires. Provision is made on rig for carrying small tools and equipment in tool compartment. Drill pipe is cut to 8-ft. lengths and is easily transported. By using tubing slips and elevators the operation of this rig is similar to that of the heavier types.

WEIGHTS: Approximate weight of rig, including truck, 7,000 lbs. Approximate weight of rig, crated for export, 10,000 pounds.

PORTABLE RIG COMPANY, Inc.

HOUSTON, TEXAS

When writing PORTABLE RIG CO., INC., *please mention The Petroleum Engineer*



Putting up an Argument

REMEMBER the lightning rod dispenser back in your green-apple days? Despite the old rascal's questionable practices, he did have an unmeetable argument—barns equipped with his rods never got hit by lightning.

But what has this to do with the Wright Oil Well Pump?

Just this: The Wright Oil Well Pump, likewise, has an unmeetable argument. It produces more oil without having to be pulled and serviced than any other pump on the market . . . so much more than the difference pays for the pump in a remarkably short time.

How is that?

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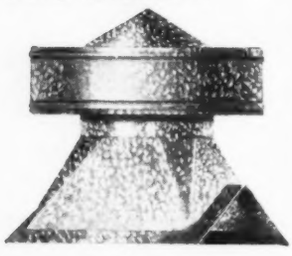

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Skelly Oil Has Largest Map

The well map in the Skelly Oil Co. office, with Barney Hays, chief scout for the company, at right.

THE largest single map ever made for the oil industry is now installed in the map room of Skelly Oil Company's land and lease department at Tulsa. It is thought to be the largest ever hung for practical use anywhere.

The map proper consists of three separate maps mounted together in one continuous sheet 25 feet and 3 inches wide and 84 feet high.

The main map, on a scale of one inch to a mile, covers all of Kansas lying west of range 9 west, all of Colorado lying east of range 58 west and south of township 1 north, all of Oklahoma lying west of range 10 west, all of New Mexico lying east of range 31 east, all of Texas lying west of the east line of Eastland County, and as far west as the western part of Brewster County and north of the south line of Kinney County—an area approximately 300 miles wide, east and west, and approximately 730 miles north and south. This region includes approximately 224,792 square miles or 143,866,880 acres, or about one-twelfth of the area of the United States. It shows sections and land surveys, producing oil and gas wells, dry holes and depths and drilling wells. In the active producing and wildcat areas is also shown ownership of land and leases. This map alone is 64 feet high.

Above the main map in the upper right-hand corner is a map of the southern part of central Kansas on a scale of two inches to the mile. It also includes a strip four miles wide in northern Oklahoma, showing the relationship of lands across the state line. The total area covered extends from the north line of township 17 in Kansas to the south line of township 29 in Oklahoma, and from the west line of range 11 west in Kansas to the east line of range 2 east. The total number of square miles included in this map is 8,064 and the map measures 13x18 feet. This brings the total area of the two detailed maps up to 232,856.

In the upper left-hand corner, above the main map, is a special section of George F. Kelly's petroleum executives' map, covering an area extending east to Birmingham, Alabama, west to El Paso, Texas, south to the Gulf of Mexico and the Mexican border and north to the Canadian border. It measures 12x18 feet and is drawn on a scale of one inch to eight miles. It shows all township and range lines and numbers, producing oil and gas fields, railways, towns and cities, oil pipe lines and refineries. It covers more than one-third of the total area of the United States.

Tall Derrick at Oklahoma City

THE largest derrick in the Mid-Continent is on Hall-Briscoe's Nellie E. Lindsay 1, SE, SW, NW, Section 2-11-3w, in the north part of the Oklahoma City field. This derrick is a seamless steel tubing one that has a height of 157 feet A. P. I. The height over all, to the top of the gin pole, is 170 feet.

The derrick was made and sold by the Marion Machine, Foundry and Supply Company of Marion, Indiana. It has a dead load capacity of 384,000 pounds, but this one has

View of the 170-foot-over-all derrick at Oklahoma City.

been reinforced with relegs and has a dead load capacity of 620,000 pounds. It will withstand a wind speed of 70 miles per hour.

The starting legs are four inches thick and 17 feet long, weighing 27.54 pounds. The other legs are four inches and seven feet long, weighing 21.36 pounds. The derrick has a 26-foot base.

The advantages of such a large derrick, in addition to the big load capacity, is the ability to handle more drill stems and longer strings of drill pipe and still leave a large amount of floor space empty. Four joints of drill stem can be handled, while 18 strings can easily be stood up in the rig with available floor space empty for work.

Smoke at Your Own Risk

People who insist on smoking at gasoline filling stations must accept the responsibility if fire and damage results, it has been ruled in superior court at Los Angeles.

A filling station proprietor brought suit against a customer, contending the defendant carelessly lit a cigarette near the gasoline tank and that the ensuing explosion damaged the station to the extent of more than $11,000. The defendant contended the proprietor had no ground for action, but the court found for the plaintiff.

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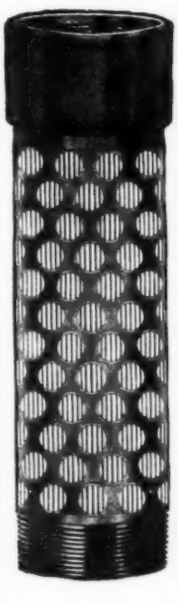

The McEVOY STRAINER has always been the choice of oil executives whose experience has taught them the value of the right screen to insure future production of the well.

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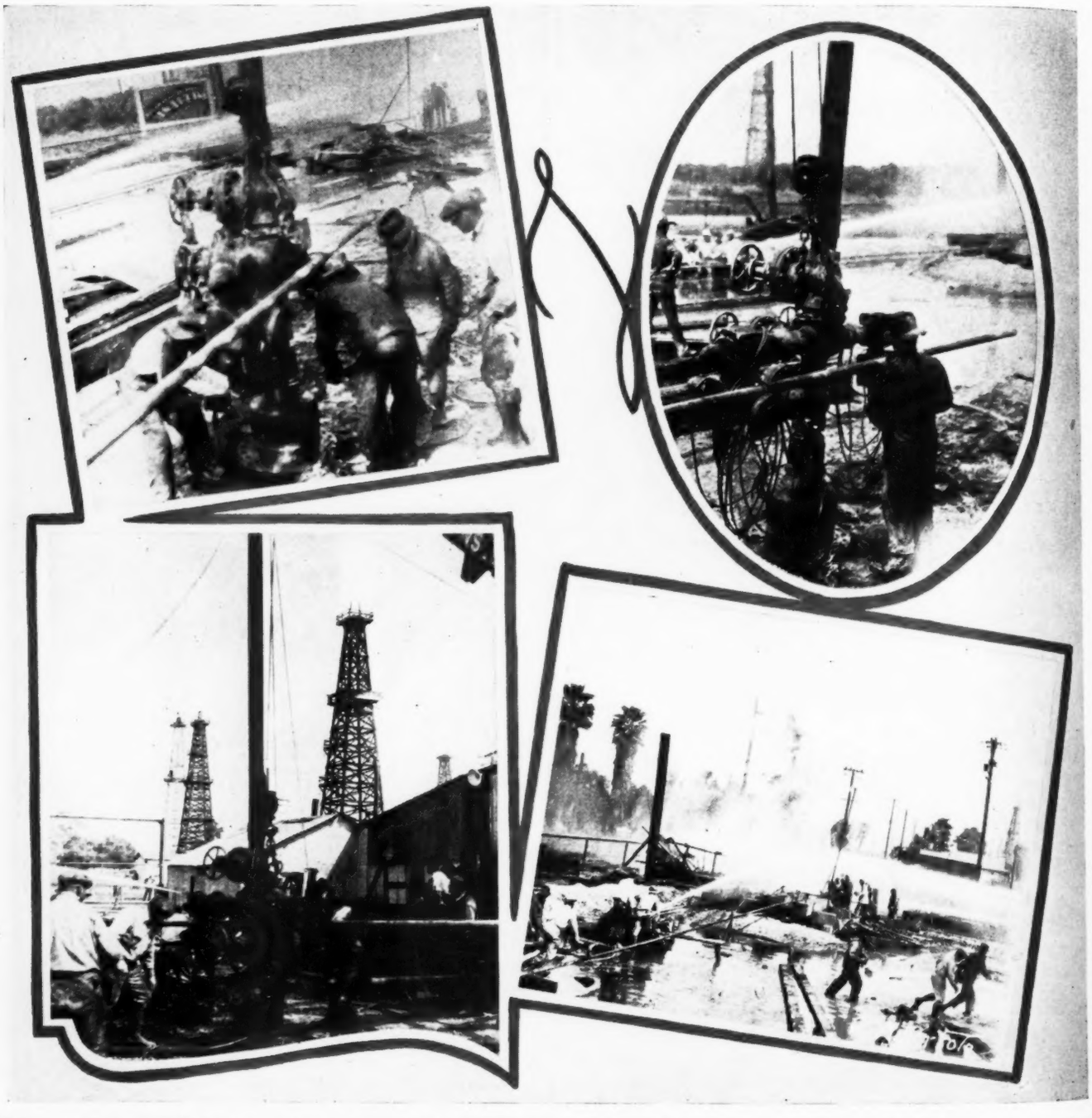
McEVOY UNIVERSAL TUBING CONTROL HEAD ready for hook-up through tubing any size from 2" to 6⅝" with casing 4½" to 13⅜". It is truly "universal," for it meets every need of the well from "drilling-in" to "pumping." Tested 2500 pounds per square inch.

Truck Crane Aids in . . .

Capping Flaming F

ALONG about April 2, 1930, when the I. T. I. O. Mary Sudik No. 1 was on its wild rampage and arousing grave concern in the Oklahoma City field, Santa Fe Springs field had a flare of excitement when a "blowout" occurred at the Bandini Petroleum Company's well No. 14 Off, and later caught fire. In order to comply with state curtailment requirements an effort was being made to cut the well's daily gas production from 4,000,000 cubic feet to 600,000 cubic feet. While "beaning" back the well to accomplish this the pressure at the casing head apparently had built up high enough to cause a welded connection to fail. Just prior to choking the well, which is producing from the Clarke Zone at about 8002 feet, it had been flowing at the rate of about 425 barrels of oil and 4,000,000 cubic feet of gas daily.

How the well was safely capped within 32 hours after

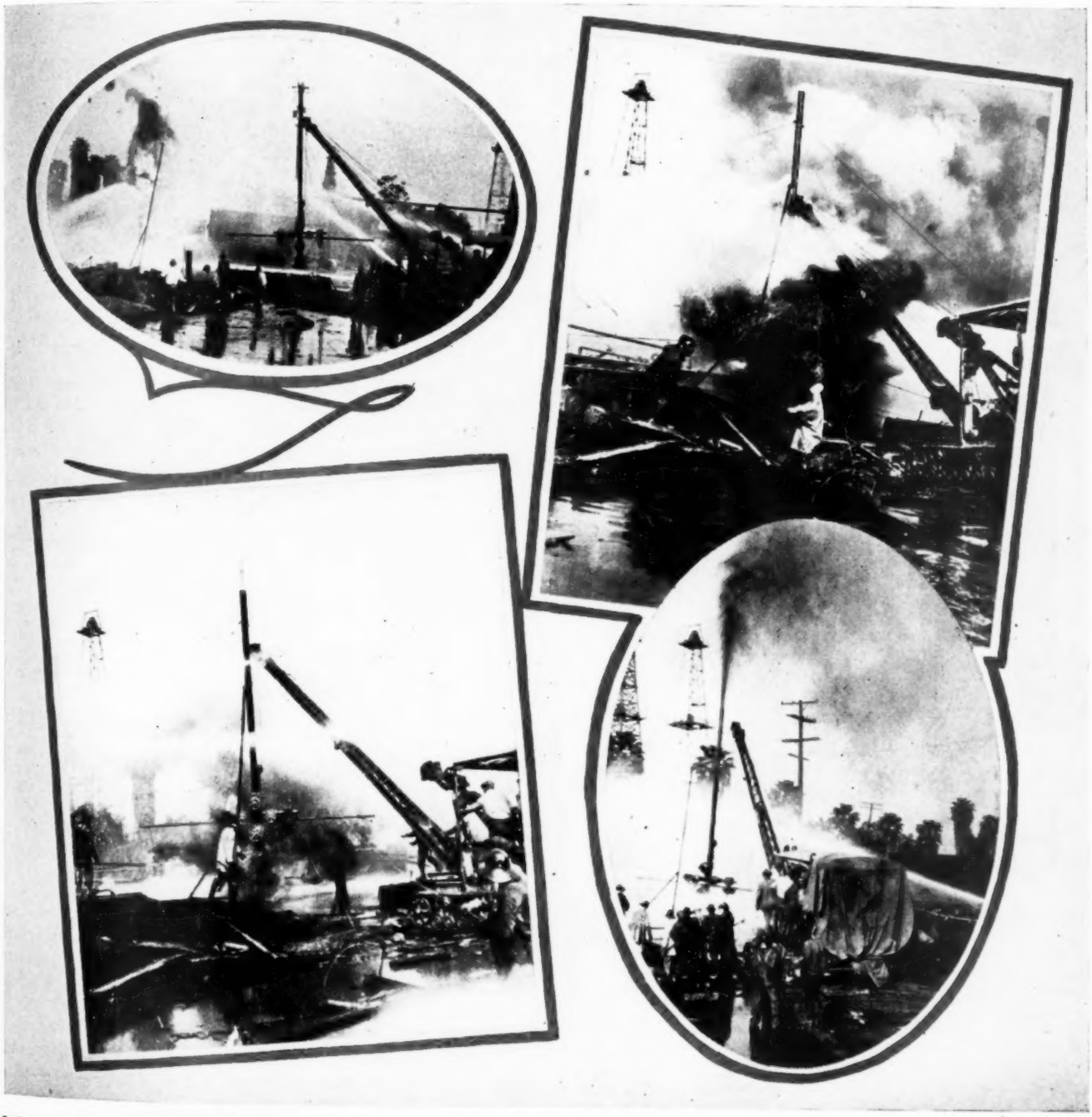


Left, top to bottom—Casinghead connections and control head made up; another view showing crew preparing guy ropes for Christmas tree connections. Right, top to bottom—Preparing guy wires for Christmas tree; streams of water being played on well.

Flowing Well » » *in Santa Fe Springs Field*

it blew out, despite the fact it had caught fire, is graphically illustrated in the accompanying photographs taken while the work of capping the well was in progress. The actual job of capping proper took only four and a half hours. Although the well was capped while burning, no injuries of any kind were suffered by the men on the job.

An interesting feature of the task of bringing this well under control while on fire was the employment of a truck crane. Christmas tree connections were made up and mounted on a control head at a safe distance from the well, after which they were properly slung, then picked up by the portable crane mounted on a tractor and moved to the well. While the capping preparations and capping were in progress several streams of water from a number of high-pressure pumps were played continuously on the well.



Left, top to bottom—Maneuvering the Christmas tree up to the well; lowering the head into place (note the water streams being played on standpipe above Christmas tree). Right, top to bottom—At the moment of placing the Christmas tree over the well—snuffing out the flame; fire snuffed out, control head safely on, and about to be bolted up.

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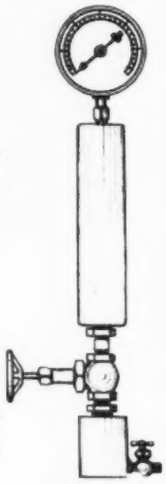

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. . . For use in the Pictorial Petroleum Section, The Petroleum Engineer desires unusual and interesting photographs. These may be of field scenes, new installations, new hook-ups, individuals, or any subjects likely to appeal to men in the petroleum industry. Especially do we want pictures of "old-timers" who are still active in the business and views with a foreign setting.

If you have such photographs, we shall appreciate your permitting us to reproduce them in our pictorial section. Extreme care will be exercised in handling them and they will be returned in the same condition as received. Kindly address photographs to—

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To Restore Collapsed Tanks

By W. F. Schaphorst, M. E.

OCCASIONALLY in the refinery, tanks or other cylindrical vessels collapse. They are "sucked in" owing to the creation of a vacuum. A regulating valve may have failed or an operator may have neglected to take proper precautions.

Don't decide forthwith that collapsed vessels of this kind must be taken out and junked and that they must be replaced by something new. Very often these tanks can be easily restored and rendered as useful as ever. Even though the collapse has been so great that the top of the tank touches the bottom, it may be possible to salvage the tank.

To restore the collapse quickly and effectively requires the utilization of water pressure to re-expand it. Very likely a single-stage centrifugal pump will not give sufficiently high pressure for the purpose, but the multi-stage centrifugal pump may do the trick. An ordinary steam or reciprocating pump may be just right. Pump water into the collapsed tank and it will gradually assume its original shape. If the tank is riveted some caulking is usually necessary. Or if the leaks are unusually bad they may be welded. It will then be possible to once more use the tank just as it was used before the collapse. Furthermore, the tank may be reinforced, if considered necessary, so as to prevent similar collapse in the future.

Rod Rack Keeps Out the Dirt

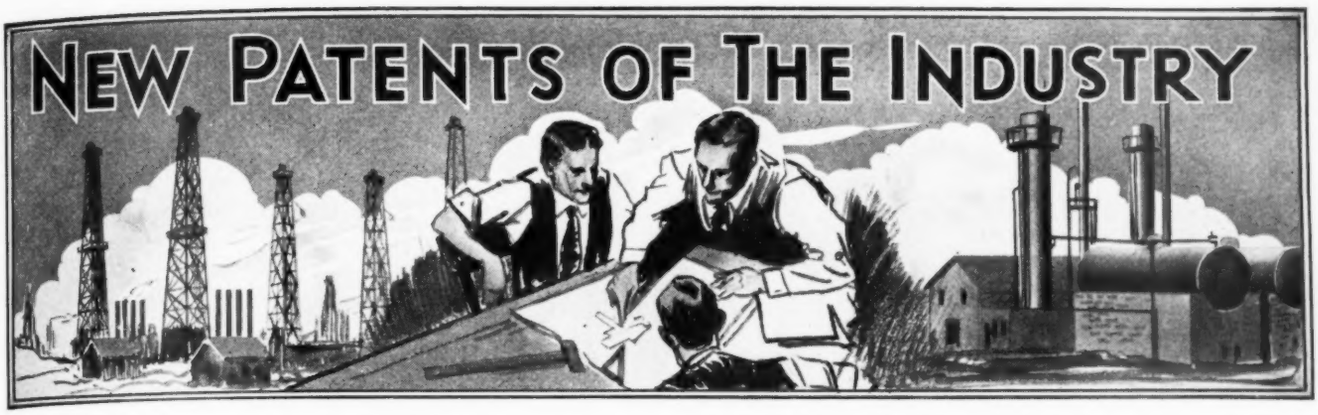
A HOME-MADE rod rack for use when the sucker rods have been pulled from the well has replaced the usual practice (if they are not strung up in the derrick) of laying them across boards placed on the ground at Comar Oil Company's No. 17 Beverlin, in the Tonkawa Okla., field.

The rack was easily and quickly constructed of used material in the machine shop of the company located in the field. It consists of a number of pairs of upright posts that rise about 18 inches above the level of the ground.

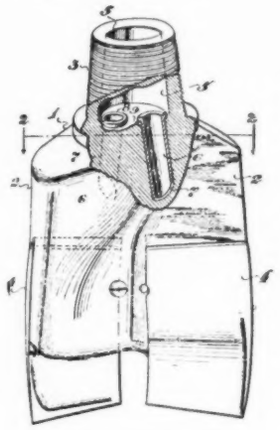
The home-made rod rack.

These are made of old small diameter pipe. A cross-bar about six inches above the ground, running between each pair of posts, offers a resting place or shelf upon which the sucker rods may be laid. Above this first cross-bar are several holes in each post into which additional cross-bars may be inserted if desired.

The rack runs from the floor of the derrick, alongside the belt and band wheel house, back to the engine room, making it easily accessible and in a handy working position. A concrete walk running from the rig back to the engine is alongside the rack to keep the workers out of the mud.

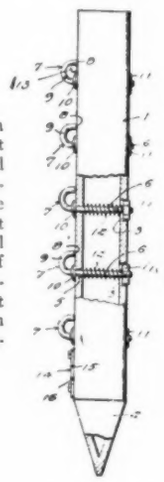


1,754,671. DRILL BIT. JOHN DAHL, Dallas, Texas, assignor to Dahl Bit Corporation, Dallas, Texas. Filed June 15, 1928. Serial No. 285,521. 1 Claim. (Cl. 255—61.)



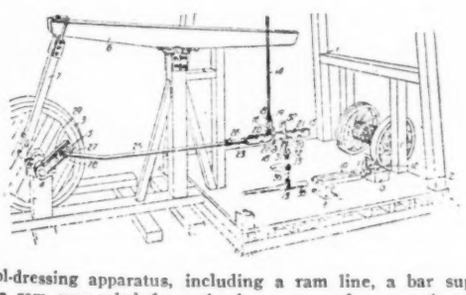
In a drill bit, a shank having angular bores and bushings in the bores having circular outwardly extending flanges on their upper ends and having depending projections on the under faces of the flanges, the bushings having their lower ends beveled to lie flush with the periphery of the shanks, the bores at the upper ends thereof having lateral recesses to receive the projections, the recesses and projections being located and related so that when the projections lie in the recesses the beveled ends of the bushings are held flush with the shank.

1,754,696. FISHING TOOL. JOHN M. SAULS, Seminole, GARTNER, Carroll, Neb. Filed Feb. 14, 1929. Serial No. 339,987. 3 Claims. (Cl. 256—54.)



2. The combination with a fence post body, of a wire holder comprising a substantially J-shaped bolt having the long side thereof reciprocably extended through the post body, a nut carried upon the terminal of said long end and slidably mounted in one wall of the body, and a spring surrounding the bolt and interposed between said nut and an opposite wall of the body and acting to draw the hooked end of the bolt against an outer face of the body to maintain a fence wire in position thereagainst, said nut being mounted to reciprocate with the bolt in an aperture in the wall of the post of the same configuration as and snugly receiving itself.

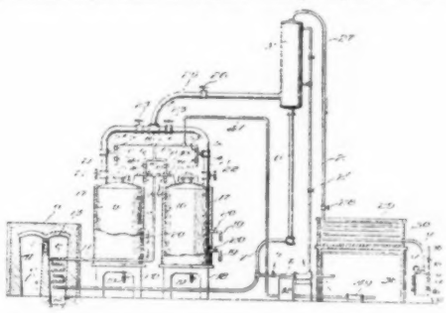
1,753,843. TOOL-DRESSING APPARATUS. CLARENCE G. WARREN, Kellyville, Okla., assignor to George Krell, Sapulpa, Okla. Filed Feb. 27, 1928. Serial No. 257,206. 10 Claims. (Cl. 76—5.)



1. Tool-dressing apparatus, including a ram line, a bar supported by the line, a ram suspended from the bar, means for actuating the bar to operate the ram, and means for adjusting the ram transversely of the line.

1,753,769. PROCESS AND APPARATUS FOR TREATING PETROLEUM OIL. ARTHUR G. BOGARDUS, New York, N. Y., assignor to Universal Oil Products Company, Chicago, Ill., a corporation of South Dakota. Filed Jan. 30, 1925, Serial No. 5,704. Renewed July 2, 1928. 4 Claims. (Cl. 196—58.)

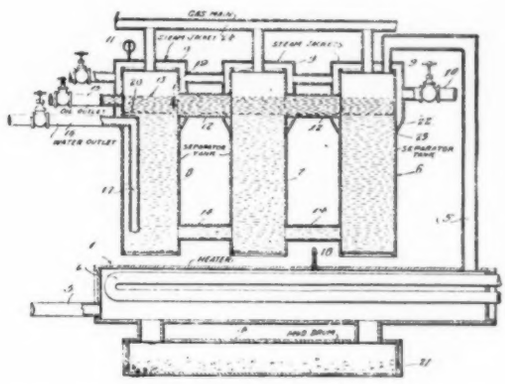
1. A method of treating petroleum oil, consisting in heating the oil, discharging said heated oil into one of a plurality of interconnected zones of reaction, where separation of vapors and precipitation of carbon takes



place, removing the vapors, dephlegmating, condensing and collecting same, maintaining a superatmospheric pressure on the said zone, interrupting the discharge of heated oil into said zone of reaction and diverting same to another of the interconnected zones, gradually reducing the pressure in the first mentioned zone while simultaneously causing the system pressure to be imposed on the zone into which the discharge of heated oil has been diverted, preventing leakage of heated oil into the zone of reduced pressure by maintaining a neutral zone of oil in the vapor connection between the zones of reaction at temperature materially below the temperature of the oil being treated, under a pressure substantially the same as the pressure on the system.

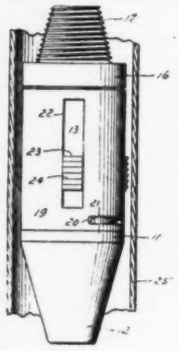
1,754,789. OIL SEPARATOR. HARVEY H. GRACEY, Fort Worth, Tex. Filed Oct. 6, 1925. Serial No. 60,856. Renewed Jan. 11, 1930. 5 Claims. (Cl. 196—5.)

1. In a separator for treating a mixture of oil, water and gas, the combination of a plurality of containers for the mixture, having connections opening communication between the same near the upper end of the containers operating to permit the mixture at the upper levels and in which the oil predominates, to flow horizontally between the con-



tainers, means for connecting the containers at a point near their lower ends operating to open communication between the same and permit the liquid at the lower levels in which the water predominates, to flow horizontally between the containers, and heating means confined to the upper ends of the containers at and above the level of the first mentioned connections for heating the upper ends only of the containers in the vicinity of the said upper levels.

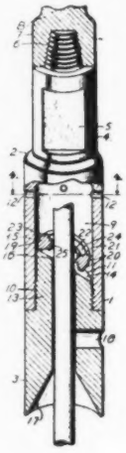
1,754,344. FISHING TOOL. Millio Frank Aloi, Huntington Park, Calif., assignor to John Grant, Los Angeles, Calif. Filed Oct. 3, 1928. Serial No. 309,983. 6 Claims. (Cl. 294—96.)



1. A fishing tool comprising: A mandrel provided with a downwardly and outwardly tapered surface, and with a longitudinal peripheral groove extending downwardly from the upper portion of the mandrel; a cage having a longitudinal slot there-through, outside of the mandrel and rotatable about the axis thereof; and a longitudinally slidable jaw within said slot, normally engaging the tapered surface of the mandrel and adapted for retraction within said groove when the cage is rotated.

1,754,816. SUCKER-ROD SOCKET. Fred C. Canniff, Tulsa, Okla. Filed June 20, 1928. Serial No. 286,889. 2 Claims. (Cl. 294—92.)

1. In combination with a barrel having a reduced opening at one end and an inclined seat surrounding the opening, a rod gripping ring slidable in the barrel having an enlarged outer portion including flat end faces adapted for contact with said seat, a relatively thin inner portion comprising flat end walls inset from said end faces and a concave inner wall surrounding the ring opening between said end walls and having annular edge forming gripping teeth.

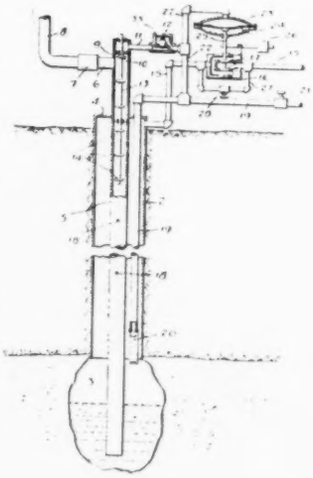


1,753,930. APPARATUS FOR PUMPING DEEP WELLS. Charles Jacobsen, Tulsa, Okla. Filed July 5, 1928. Serial No. 290,512. 1 Claim. (Cl. 103—5.)

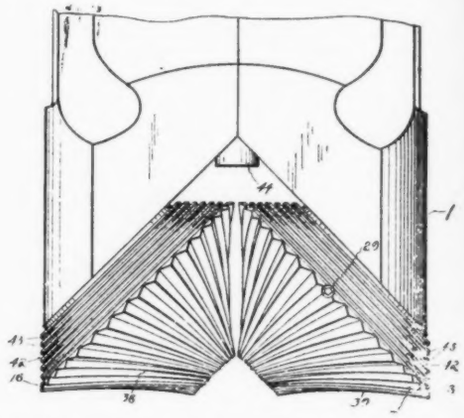
Apparatus for pumping deep wells including in combination with well casing, a liner in said casing and extending therefrom into the well hole, a packer between the liner and the casing, tubing in the casing resting on the liner and having ports above the packer, a standing valve in the liner, a plunger in the barrel above the standing valve, rods connected with the plunger and extended through the tubing, and means for delivering pressure medium to the tubing through the casing and said ports, the tubing having auxiliary ports below said first-named ports for admitting fluid from the barrel to the casing below said first-named ports.

1,754,945. METHOD AND APPARATUS FOR FLOWING OR PUMPING WELLS. Richard M. Haskell, Bradford, Pa., assignor of three-fourths to Tide Water Oil Company, Bayonne, N. J., a corporation of New Jersey. Filed Aug. 5, 1927. Serial No. 210,799. 17 Claims. (Cl. 103—11.)

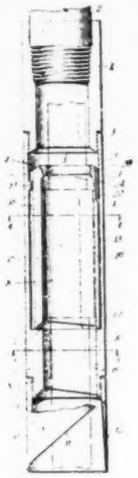
1. The method of flowing wells which comprises maintaining a back pressure on an aeriform operating medium escaping from the well, utilizing the pressure of such medium to keep a flowing medium turned off from the well, and utilizing fall in pressure in said medium due to rise of liquid in the well to bring about turning on of the aeriform flowing medium.



1,754,848. ROLLER-CUTTER DRILL. Clinton H. Bull, Columbus, Ohio, assignor of one-half to Clarence C. Le May, Columbus, Ohio. Filed Jan. 14, 1926. Serial No. 81,243. 5 Claims. (Cl. 255—71.)



1. The combination with a rotary drill head, a spindle carried by the head, a bearing removably mounted on the spindle, a cutter rotatably mounted on the bearing, and a washer interlocked with the bearing and capable of being rotated to apply or remove the bearing from the spindle.

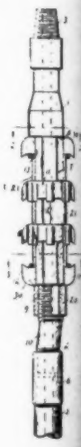


1,754,696. FISHING TOOL. John M. Saula, Seminole, Okla. Filed Dec. 4, 1928. Serial No. 323,613. 12 Claims. (Cl. 294—92.)

1. A fishing tool including a barrel, means associated with the barrel whereby the latter may be rotated to engage a "fish," means for locking said barrel and its associated means against relative movement, and means for forming a seal between the barrel and "fish."

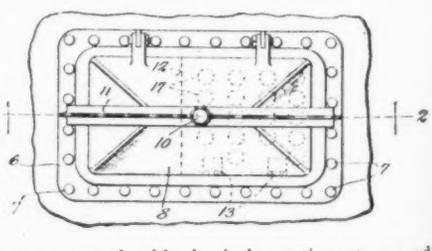
1,754,830. UNDERREAMER. John W. MacClatchie, Compton, Calif. Filed Nov. 20, 1926. Serial No. 149,582. 9 Claims. (Cl. 255—73.)

1. A reamer comprising rotatable supporting means having an axially offset portion forming a mandrel which is non-rotatably fixed relative to the supporting means, and a cutter non-rotatably mounted on the offset mandrel for eccentric rotation of the cutter by the supporting means.



1,753,394. THIEF-HOLE COVER. Orville C. Watson, Skiatook, Okla. Filed May 31, 1928. Serial No. 281,909. 1 Claim. (Cl. 220—57.)

A sample supporting tray for tanks, including a body portion formed of a length of sheet metal perforated to permit liquid to pass there-



through, a hinge connected with the body portion at one edge thereof, means for securing the hinge to the tank, an arm pivotally connected with the body portion at one side thereof, means for adjustably securing the arm to the tank to support the body portion in a horizontal plane